

1 PANDAS & PANS An Integrative Approach

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- Diagnostics

4 Overview

4 Overview

- Course Outline
- 1. Symptoms
- 2. Mechanisms
- 3. Diagnostics
- 4. Conventional treatment approach
- 5. Integrative treatment approach
- 6. Recovery essentials
- 7. Cases

5 Diagnostics

- Clinical diagnosis
- PE and symptoms as clues
- General diagnostics
- Infectious triggers
- Environmental triggers

6 Diagnostics

- Reminder ~
These are

- CLINICAL DIAGNOSES

- If a P/P-specific test was negative, a child can still have PANDAS or PANS.

- IME, we are relying too much on antibody tests to diagnose these conditions. Because many of these kids have subclinical immune deficiency, many don't have a strong enough antibody response to affect the test. This may lead to a falsely normal test.
- Be mindful of the steroid effect on antibody-based labs.

7 Neuro P/E relevant to BGE

- Burdened appearance
- Dilated pupils
- Hypotonia
- Motor apraxia
- Dyspraxia
- Normal strength
- Normal reflexes, not hyperactive as in Wilson's dz
- Abnormal movements
- Chorea
- Choreiform movements, not age appropriate
- Tics
- Steriotypies
- Ballismus
- Overall rational irrationality (they realize or have insight into the abnormality)

- Presented by Dr. Elizabeth Latimer
- Autoimmune Encephalitis Post-Streptococcal Evaluation & Treatment Conference Oct 2019

8 Honor the triggers

- Once the autoimmune process has started...
- Environmental exposures and infections can and will flare them.
- ***the child knows where/who is carrying something that will put them at risk***
- And will tell you with their behavior - honor that.
- It's not pathological. It's the innate intelligence of the system at work.
- Certain spaces/places may be the trigger.
- Parents/siblings/caregivers may be the trigger.
- Parent self care is critical in order to not be a carrier.

9 Additional triggers

- Lose a tooth/dental visit
- Puberty onset
- Injury
- Sunburn
- Allergies
- Many bug bites/spider bite

- Family strife/move/loss of structure
- Loss of friendships
- Abuse

10 Symptoms with hints toward cause

- Congenital Borrelia (Lyme) ~
Atonia (reported 97% prevalence congenital Lyme by Dr. Charles Ray Jones)
- Bartonella ~
Rage/aggression
- EBV ~
Fatigue/"laziness", chronic sore throat
- Glyphosate + Mold ~
Anxious
- Glyphosate + Bartonella ~
Persistent, non-specific abdominal pain
- Mold ~
Urinary frequency/urgency without infection, dysautnomia, PoTS
- Mold + Bartonella ~
Hypermobility
- Candida ~
Despair, suicidality

11 Diagnostics

- Clinical diagnosis

- Clinical diagnosis

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12 General diagnostics

- PANDAS/PANS (Cunningham)
- Other neuro antibodies
- Immune competence (IgGAME, PID, CVIDS, lymphocytes)
- Imaging - Neuroquant
- Food sensitivity
- Sinunasal microbiologics
- Drug metabolism
- Genetic predispositions/expressions
- Testing for coverage
- On the horizon

13 Cunningham Panel TM

- Considered (+) if one or more of these markers is elevated.
- Suggests that neuropsych sx's may be due to an

autoimmune process.

- 5 markers:
 1. Anti-Dopamine D1 Receptor (psychosis, OCD and tics)
 2. Anti-Dopamine D2L Receptor (uncontrolled motor movements, hyperactivity and impulsivity)
 3. Anti-Lysoganglioside-GM1 (sleep disturbances, behavioral regression, obsessions/compulsions)
 4. Anti-Tubulin (OCD-like symptoms and cognitive impairment/brain fog)
 5. Calcium/calmodulin-dependent protein kinase II (CaMKII) (involuntary movements, cognitive interference, emotional lability)
- CaMKII is a cell stimulation assay; measures the ability of a patient's autoantibodies to stimulate the CaMKII enzyme in human brain cells.
The CaMKII is involved in upregulating the production of neurotransmitters – dopa, epi, and NE.
- Best suited to classic PANDAS?

14 Autoantibodies

- Antinuclear antibodies multiplex, reflex to dsDNA, RNP, Sm, SS-A, SS-B
- Demyelination Antigens ~
Anti-tubulin IgM/IgG+IgA
Anti-myelin basic protein IgM/IgG+IgA
- BBB Disruption ~
Anti s100b IgM/IgG+IgA (*increases with exercise)
- Optical and ANS Disorders ~
Anti-neuron specific enolase IgM/IgG+IgA
- Peripheral Neuropathy ~
Anti-GM1 IgM/IgG+IgA
Anti-GM2 IgM/IgG+IgA

- Brain Autoimmunity ~
Anti-HSV1 IgM/IgG+IgA
Anti-cerebellum IgM/IgG+IgA
Anti-purkinje cell IgM/IgG+IgA
Anti-pituitary antibodies (APA) (hypophysitis post TBI)

15 Immunocompetence

- Quantitative IgG with IgG subclasses ~
Red top tube or SST? Depends on goals for testing.
Serum separator will bind some antibodies and under-report, esp in those with low Ig's.
(🙏 Dr. Paul Anderson)
- NOTE that all antibody-based testing will be affected by IVIG, including other autoimmune and infection.
- Lymphocyte Subset/Differential Panel ~
Offers the advantage of detecting the cell type that causes the immune defect.
- 3 types of lymphocytes: B, T and NK cells.
All share the same progenitor cells: hematopoietic stem cells in the bone marrow, which then give rise to multipotent progenitors, to early lymphocyte progenitors (ELP) and eventually to the differentiated progenitors of NK, B or T cells.
B and T lymphocytes are both antigen-specific lymphocytes and the main regulators of the adaptive immunity.
NK cells, in contrast, are not antigen-specific lymphocytes, thus belonging to the innate immune system.
- PMID: 30248214

16 B cell differentiation

- PMID: 30248214, 31694331

17 T cell differentiation

- PMID: 30248214

18 Identifying Primary Immunodeficiency

- Low absolute lymphocyte count (<3,000/mm³) suggests a cellular immunity defect and constitutes a strong indication for lymphocyte subset count (LSC).
*However, normal ALC cannot exclude such a defect.
- LSC is one of the initial screening tests by general pediatrician for investigation of an immunological patient, with LSC being affected by age (Table 2 - next slide.)
- Imperative to order LSC when a child presents with recurrent or opportunistic infections and the ALC is <3,000/mm³.
- Combination of good clinical examination with good interpretation of LSC will facilitate the dx of most of the common PID.
- Approximately 50%–60% of all identified PID are caused by defects in antibody production. Such patients usually develop upper and lower respiratory infections, especially from encapsulated bacteria, as well as chronic GI infections from *Giardia lamblia* or enterobacteria.
- A characteristic feature of these humoral immunity defects is the deterioration of the clinical profile after the first 6 months of life, as the levels of maternal antibodies start to recede.
-
- PMID: 30248214

19 T cell differentiation

- PMID: 30248214

20 Common Variable Immunodeficiency (CVID) in peds

- Mean age at symptom onset was 18 (3-204) months.
- All CVID patients with pediatric onset had decreased levels of total and memory B cells, CD4+ T cells, CD4+CD45RA+ naive T cells, and recent thymic emigrant (RTE) cells.
- On the other hand, they had increases in CD8+CD45RO+ memory T cells.
- Specific cellular abnormalities associated with the reduction in B and NK cells and increase in CD8+ T cells were found in patients with bronchiectasis.
- In pediatric CVID patients, low serum IgA levels and decreased numbers of naive T and RTE cells were determined as risk factors for chronic diarrhea.
-
- PMID: 31901904

21 Neuroquant MRI

- Specialized MRI must be run at specific Neuroquant centers.
 - TBAR with asymmetry
 - may need to order Brain Development report b/c TBAR changes may reflect neuronal development. (Dr. Gazda)
- Does not require contrast. Age- and gender-matched controls.
- Normal = 40-60 percentile.
- May display enlargement of the caudate.
 - Blue = edema/inflammation
 - Red = atrophy
- Thalamus >90% mold and Lyme. (Dr. Ackerly)
- Not ideal for child with tics as they can't remain still for imaging

not ideal for child with tics, as they can't remain still for imaging.

- Also not ideal for sound sensitive child or child who cannot tolerate ears being covered.
- Braces/retainers will alter findings.

22 Neuroquant Ped Multistructure Atrophy Report

- zonulin stool, food allergy, micro/mycobiome

23 Neuroquant Triage Brain Atrophy Report TBAR

- zonulin stool, food allergy, micro/mycobiome

24 Food sensitivities

- Proteins vs Peptides
- Proteins ~
Measure immune system reactivity to whole, undigested, multi-dimensional (ie: 4D) proteins.
Challenges: only detect one aspect of "the elephant in the gut"
Limited to testing the water-soluble portions of proteins, leaving out non-water-soluble peptides (ie: gluten).
- Peptides ~
Measure immune system reactivity to the small, typically not water-soluble, 2D peptides created when whole proteins are digested.
Reduces cross-reactivity; increased sensitivity because peptides are highly specific to the food from which they are derived.
- Antibodies to a whole protein will not recognize or bind peptides, even if those peptides are found in that whole protein.

- Clinically, testing for food sensitivities at the peptide level in addition to whole protein eliminates uncertainty around food reactions.

25 Sinusnasal microbiologics

- Colonization involves a mixed microbial presence.
- Marcons - yes, it's still "a thing", but other culprits are Pseudomonas and Klebsiella
- Chronic rhinosinusitis patients undergoing endoscopic sinus surgery. Those with biofilm had ~
More severe disease preoperatively
Persistence of postoperative sx's
Ongoing mucosal inflammation
Increase infections
- Fungal cultures inherently under-report due to inappropriate medium and duration (fast-growing species eat all the food, miss more pathogenic species.)
- Dx via NGS qPCR and appropriate culturing.

26 Drug metabolism genetics

- Ultrasensitive to psychiatric medication ~
Due to BBB integrity or genetics?
- Better to know child's drug clearance before prescribing, especially if the effect is slower metabolism and reduced drug clearance, concentrating the drug.
- Testing provides Gene-Drug interaction chart.
- Also be familiar with co-enzymes that up- or down-regulate that pathway.
ie: B2, B6, NAD

27 Genetic predispositions/expressions

- PANS: HLA alleles:

HLA-B 38, 52, 55

- My own observations:
Snps related to IgG: Fcγ Receptors
Snps related to NTs: COMT, MAOA
Snps related to detox:
Phase I: CYP1A2, CYP1B1, CYP3A4 (mold)
Phase II: GSTM1, MTHFR, SUOX
Snps related to histamine: DAO
- Metagenomics/metabolomics

28 The fine art of insurance coverage

- Set up for IVIG coverage in case it's needed in the future (analogous to starting an IV in the ER)
- ****don't put PANDAS or PANS Dx in chart, unless you're in a state which mandates coverage****
- Test IgG and IgA (plus subclasses) ~
 - Using SST tubes
 - Test after 3 weeks without any integrative supportive measures (test the child's true nature.)
 - Test at the tail end of a steroid burst, if needed.
- Also engage parent help. Bring child in every time they get sick to get it on the medical record.
- Parent needs to keep school absence records, sports absence records, performance absences, etc.
- Cautions ~
Zinc lozenges, silver nasal sprays, propolis throat sprays turn positive Strep tests to negative.
Diet, supplements, sleep routines, chiropractic adjustments, and all the other integrative treatments really work!
We see immune numbers improve, which is great for the child, but bad for proving the need for treatment.

A hiatus helps reveal the baseline.

- Pneumococcal vaccine titers are not necessary, plus may be falsely lower in kids with hypogam. Push back against insurance on this.

29 On the horizon?

- Metagenomics: NGS qPCR of brain/CSF
- Metagenomic NGS is a novel diagnostic test with the potential to revolutionize the diagnosis of pediatric meningitis and encephalitis through unbiased detection of bacteria, viruses, parasites, and fungi in cerebrospinal fluid.
- "We recommend NGS should be considered as a front-line diagnostic test in chronic and recurring presentations and, given current sample-to-result turn-around times, as second-line in acute cases of encephalitis."
- PMID: 29305150, 34951470

30 Diagnostics

- Clinical diagnosis
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31 Infectious triggers

- Group A Beta-Hemolytic Streptococcus Pyogenes
- Mycoplasma pneumonia
- Chlamydia pneumonia
- Bartonella species
- Borrelia species (Lyme and Tickborne Relapsing Fever [TBRF])
- Encephalitis viruses
- Influenza
- SARS-CoV-2
- Periodontal

32 Streptococci

- Streptococci are part of the normal human respiratory flora
- Commensal and non-commensal - most are protective
- Passed by respiratory droplets and saliva ~
Not considered highly transmissible on surfaces but is possible
- Immunity to one strain does NOT confer immunity to any other
- 20 different subgroups of beta-hemolytic strep; not a homogenous population ~
Hundreds of different strains (220 M proteins x 25 T proteins)
Capsule is different for each of the Lancefield groups
Exotoxins also different

- High antigenicity of Streptococcal exotoxins ~
Can turn on 20-40% of T-cells
This is how Strep doesn't need to be in the brain to affect the brain.
- B. J. B. Wood et al. (eds.), The Genera of Lactic Acid Bacteria © Chapman & Hall 1995

33 Group A Strep (GAS)

- GAS is the dominant respiratory pathogen ~
Accounts for 20%-40% of cases of pharyngitis in children; the remaining are caused by viruses
- GAS infections ~
Strep pharyngitis, otitis media, sinusitis, skin infections (perianitis)
Colonization posited in sinuses and GI
- GAS sequelae ~
Scarlet fever, cellulitis, necrotizing fasciitis, rheumatic fever, Streptococcal toxic shock syndrome, and post-Streptococcal glomerulonephritis
-

34 Strep shoots the messenger

- Rewires the immune system for its survival
- Unique in its abilities to ~
Direct I/S remodeling in nose/throat (possibly perianally)
Promote its own replication
Alter I/S responses
- "Shoots the messenger": GAS virulence factors modulate maturation and survival of dendritic cells (DC) aka the "delivery" cells, effects that are likely to have a critical impact on activation of innate and adaptive immune responses.
- Only 6 of 24 GAS strains tested induced surface expression of MHC class II and co-stimulatory molecules

- Only 6 of 24 GAS strains tested induced surface expression of MHC class II and co-stimulatory molecules consistent with DC maturation.
- The majority of the strains did not promote DC maturation, and many triggered DC apoptosis.
- PMID: 19712038

35 Strep Pharyngitis (GAS)

- Symptoms ~
 - Sore throat
 - Pain with swallowing
 - Red or swollen tonsils
 - Swollen cervical lymph nodes
 - Fever
 - Headache
 - Red petechiae or pinpoint dots on the roof of the mouth
 - Angular cheilitis
- Ddx ~
 - Viral cause. Children with Strep pharyngitis typically do not have cough, runny nose, hoarseness, mouth ulcers, or pink eye. These symptoms suggest a viral cause.
- Seasonality ~

- Seasonality ~
Winter & spring

36 Perianal Strep Dermatitis (GAS)

- Symptoms ~
Red rash around the anus with a well-defined margin
Sore rectum or anus
Anal pruritus
Pain with bowel movements or when wiping
Constipation
- Ddx ~
Candidiasis, pinworms, eczema, and contact dermatitis from soaps, detergents, and fragrances
- Seasonality ~
Winter & spring
- Culture all perianal rashes AND culture to confirm successful treatment.
Not uncommon to have pharyngeal culture neg, but perianal positive.

37 Skin infections: Suppurative

- Impetigo - honey-colored crust, superficial - heals without scarring.
- Ecthyma - deeper lesion, below dermis, indolent. Starts as a pustule and erodes to an ulcer. Often multiple lesions.
- Erysipelas - raised red rash with very sharp borders. In the lymphatics of the skin. Fever and pain from skin

swelling. IV Abx.

- Cellulitis - border vague and irregular. Skip areas/bare areas. Painful, may not have fever. Associated with a break in skin.
- Lymphangitis - rapidly progressive infection with initial cutaneous focus but spread of infection through lymphatics.
- Necrotizing fasciitis/streptococcal myositis - Streptococcal gangrene. Superficial and possibly deep layers of muscles are killed. Pain and swelling are disproportionate to everything else. Needs surgery.
- Streptococcal pupa fulminans - Skin and all structures underneath necrose. Blood vessels thrombose. + blood culture usually.

38 Skin: Nonsuppurative

- Sandpaper skin
- Desquamation fingers/toes (also mold)
- Fingernail/1st thumb - splinter hemorrhages
- Scarlet fever: strain dependent. Diffuse erythematous rash due to the production of pyrogenic exotoxin, most commonly assoc w pharyngitis.
- Scarlet fever - forms pastia's lines (bright red coloration of the creases under the arm and in the groin), strawberry tongue.
- Cuttata (drop like) necrotic

- Guttate (drop-like) psoriasis.
- Erythema marginatum - assoc w ARF. Rash location may change over time. Pink to red with central clearing and serpiginous (wavy) spreading edges and often are unnoticed by the patient or parent because they are painless and non-pruritic.
(distinction from Lyme erythema migrans.)
- PMID: 27051572; Steere, A., Strle, F., Wormser, G. et al. Lyme borreliosis. Nat Rev Dis Primers 2, 16090 (2016).
<https://doi.org/10.1038/nrdp.2016.90>

39 Other exposures

- Strep "carriers" ~
Check parent/siblings tonsils
Often child's are small and parents/siblings are enlarged or boggy (may also be EBV)
Check skin infections of other family members
- Pets ~
Animals cannot get infected by Strep as it's strictly a human pathogen
Transfer via saliva from licking carrier's face or skin infection
- Probiotics ~
Until we know which peptide or protein induces an immune reaction, I recommend avoiding Strep-based probiotics

40 Neonatal (Group B)

- Group B Streptococcus
- Debated the degree to which Group B Strep in mom before birth contributed to the development of PANDAS, but doctors specializing in PANDAS have reported a correlation.
-

- Vaginal swab culture

41 Why worry about Strep in PANS?

- Strep is kryptonite in kids with PANDAS -and- PANS
- Even though it may not have been the triggering infection, Strep can trigger flares in PANS.
-

42 Strep detection

- Culture culture culture ~
Antibody response is more complex than previously understood. A negative rapid strep test can still be culture positive. F/U negative rapid with culture.
- Rapid strep tests ~
Very high specificity (98-99%) = very few false positives.
However, sensitivity lower (90-95%) = greater chance of false negatives.
Package insert recommends F/U negative tests with a culture.
Lawsuits against docs who didn't F/U with culture, missed Strep, and serious sequelae.
- Cochrane Database Systematic Review 2016 ~
Out of 100 children with strep throat:
86 would be correctly detected with the rapid test
14 would be missed and not receive antibiotic treatment
- Is clinical over-reliance in rapid strep tests a contributing factor for the rise in PANDAS/PANS?
- PMID: 27374000

43 Additional Strep labs

- Anti-DNase B - repeat in 2–6 weeks for antibody rise or fall
Note: not anti-human DNA. DNase B or Deoxyribonuclease B is an antigen produced by group A streptococci which contributes to Strep's pathogenicity.
- ASO - repeat in 2–6 weeks for antibody rise or fall ~
Significant prevalence of seronegative ASO (Dr. Cleary)
- Streptozyme - similar to Anti-DNase B.
-
- How to test others if not your patient? (harder since EMR)

44 Mycoplasma pneumonia

- Look for it, and look again, and again. It's ubiquitous and often asymptomatic or only mild illness.
- Shares many of the same skills as Strep in evading the I/S and affecting the brain. Second most favorite places to play in the body are brain and CNS.
- Can cause encephalitis. CNS complications are seen more so in kids. Just like Strep, certain proteins on Mycoplasma mimic brain tissue.
- Been shown to be able to persist in an intracellular environment. Antibiotic resistance issues.
- Do not develop lifelong immunity to Mycoplasma.
- More common in the winter and is estimated to be much more common than previously understood.
- A super-spreader: takes up to 3 weeks before symptoms develop and is shed from the respiratory tract for many weeks after symptom abatement.
Equates to up to 6 weeks of potential transmissibility with one infection.

- Sometimes, Mycoplasma's main hideout is the tonsils. For children whose tonsils have become Mycoplasma reservoirs, removing the tonsils may be helpful.

45 Mycoplasma pneumonia symptoms

- Symptoms of respiratory Mycoplasma in children under 5:
 - Watery eyes
 - Runny nose or sneezing
 - Sore throat
 - Digestive changes such as diarrhea or vomiting
- Symptoms of respiratory Mycoplasma in children 5 years or older:
 - Feel tired
 - Low-grade fever
 - Sore throat
 - May have a headache
 - Slowly worsening dry cough that may last for weeks
- The cough is normally dry. Even though it commonly takes weeks for the cough to go away, it should stay dry. If the cough becomes productive, and is accompanied by worsening fever or chills, or feeling SOB, r/o "walking pneumonia".
- Mycoplasma may cause other non-lung symptoms, such as achy muscles and joints, skin rashes, heart symptoms, liver inflammation, and eye symptoms such as pink eye and anterior uveitis.
- Also mimics RBCs and can lead to hemolytic anemia. May be mistaken for Babesia, which infects RBCs and causes many of the same circulatory symptoms.

46 Mycoplasma detection

- IgG may or may not be positive with a positive IgM.
- IgM remains positive much longer than other microbes, so can be a false positive.
- Confirm IgM+ via immunofluorescence (Mayo) - titers vary wildly by the moment.
- T-cell option

47 Chlamydia pneumonia

- Respiratory infection, not the STI Chlamydia trachomatis.
- Obligate intracellular bacteria that infects the respiratory epithelial tissue and may play a role in chronic inflammatory dzs.
- Majority of individuals are exposed throughout their lifetimes with an antibody prevalence of 50% by age 20 and 80% by 60–70 years old.
- Predominantly asymptomatic or mild, but can result in the development of acute upper and lower respiratory illness including bronchitis, pharyngitis, sinusitis, and pneumonia/community-acquired pneumonia.
- CNS can also be a target.
- Co-infection of *C. pneumoniae* and *M. pneumoniae* with SARS-CoV-2 is associated with more severe features.
- PMID: 30687565, 23218799, 11371760, 33482238

48 C. pneumonia

- May contribute to a range of inflammatory diseases.
- Dissemination from the lung throughout the body can possibly lead to atherosclerosis, arthritis, as well as

neurological diseases, such as Alzheimer's, MS, and schizophrenia.

- May also be associated with biliary cirrhosis, diabetes, and Behcet's disease.

49 C. pneumonia detection

- T-cell
- Chronic infection is somewhat more difficult to determine and requires the detection of persistent IgG levels, which is complicated by the fact that IgG has a half-life of weeks to months and may therefore be present for some time following acute infection.
- It has been proposed that IgA levels may provide a better indication of chronic infection, but according to Dowell et al., the use of IgG and A serological markers alone should not be used.
- Identification of *C. pneumoniae* messenger RNA (mRNA) by PCR can also be used to determine whether *C. pneumoniae* is in a metabolically activated state.
- PCR detects presence within tissues (ie: tonsils.)
- PMID: 8665464, 11462186

50 Bartonella spp

- Include a number of different species, which are growing in number as detection improves.
- Transmitted through flea bites, tick bites, and scratches or bites from an infected animal. Vertical transmission during pregnancy.
- Best known as cat scratch fever, but that's misleading.
 - A scratch isn't required (vector bite).
 - Not just cats - also dogs, rabbits, and many other pets such as hamsters and gerbils.
- Can disperse far and wide in the body, and can migrate in and out of the blood. This causes a relapsing-remitting pattern, making it quite difficult to discern between a chronic *Bartonella* infection and a PANDAS or PANS flare.

- Each species causes a slightly different symptom picture, which makes diagnosis difficult. There are commonalities based on favorite tissues to infect, those being the brain, nervous system, and connective tissue, especially collagen.

51 Bartonella

- Formerly, considered an issue only for those with severe immune compromise.
- New research is supporting what many of us working with P/P kids have found—it's far more common and often chronic. May even be "asymptomatic", but with the rising prevalence of anxiety and hypermobility in kids, one wonders about that.
- Anxiety is the most common brain-related symptom with Bartonella, as well as neuropathies. We also see mood swings that can be quite drastic and seemingly unprovoked. These may present as out-of-control anger and rage events.
- Regarding connective tissue, research suggests that Bartonella impairs collagen synthesis and repair. (So does mold.) This mechanism accounts for the "Bartonella stretch marks."
- This collagen-interrupting effect is why many cases of hypermobility are due to undetected, chronic Bartonella in kids and teens living in moldy environments.
- We worry about Bartonella's effect on the connective tissue of our hardest-working tissues, such as the eyes and the heart, where it can weaken and infect the heart valves.
- Acute cases typically fit the classic s/sxs, but chronic Bartonellosis is missed frequently due to the variance in how it presents in different children.

52 Acute Bartonella spp

- Fever
- Ice-pick pains, especially of the ear
- Skin rashes or nodules
- Stretch marks that don't blanch

- Stretch marks that don't blanch
- Extremely enlarged lymph nodes
- Anger or rage events
- Hemolytic anemia
- Joint pain
- Uveitis
- Neuroretinitis
- Encephalitis
- Endocarditis

53 Pics

- Bartonella: Cutaneous lesion presentation depends on strain. "Bart striae" or non-blanching stretch marks.
- PMID: 33291688

54 Chronic Bartonella spp

- Anxiety
- Mood swings
- Memory problems
- Fatigue
- Low-grade fever
- Headache, migraine

- Eyes sensitive to light
- Red crescents at the back of the throat that come and go
- Generalized ear or throat pain
- Occasional problems with swallowing
- Crawling sensation on skin
- Nerve zinging, vibration, or pain
- Hypercoagulability
- Generalized lymphatic stagnation
- Gastritis, reflux
- Heart palpitations with or without chest pain
- Hypermobility
- Migrating joint and muscle pain
- Injuries slow to heal
- Plantar fasciitis, worse on first steps in the morning

55 Pics

- Bartonella throat crescents

56 Bartonella diagnostics

- Acceptable to treat based on a presumptive diagnosis.
- Famously difficult to detect due to their migratory pattern from the blood into tissues, evading the I/S.
- IFA, PCR, T-cell
- “ILADS folklore” - draw between 2-4pm
- May provoke with homeopathics for 1 week prior.

57 Borrelia

- Ticks that transmit Lyme Disease reported in 48.6% of US counties (*Ixodes scapularis* and *pacificus*)
- Technically refers to *Borrelia burgdorferi sensu lato*
Encompasses 18 known species
(ex: *B. burgdorferi sensu stricto*, *afzelii*, *garinii*, *mayonii*, *californiensis*, *japonica*, *andersonii*, *lusitaniae*, *bissettii*, *spielmanii*)
The most human pathogenic species to date (N of equator) ~
 - *B. burgdorferi sensu stricto* (US & Europe)
 - *B. afzelii*, *garinii* (Europe & Asia)
- Tick-borne relapsing fever *Borrelia* (TBRF) ~
B. hermsii, *turicatae*, *parkeri*, *miyamotoi*
- Louse-borne relapsing fever *Borrelia* (LBRF) ~
B. recurrentis
- Coinfection is the norm, not the exception ~
Bartonella, *Babesia*, *Anaplasma*, *Ehrlichia*, *Powassan*, *Franciscella* (Tularemia), *Rickettsia* (RMSF), Q Fever, etc

58 Covid

59 Prevention is Key

- Attractors ~
CO₂ is the tick attractor.
Also pheromones from Lyme carriers.
Certain mosquito-attracting (flavi)virus-induced skin volatiles:
Acetophenone, a volatile compound that is predominantly produced by the skin microbiota, is enriched in the volatiles from the infected hosts to potentially stimulate mosquito olfaction for attractiveness.
An effect partially combatted by Vitamin A.
- Defense ~
Treated clothing
Essential oil - lemon eucalyptus, yarrow (acaricidal); reapply often (min hourly)
Coming inside: clothes stripped and in hot dryer x 10 min
Tape roll pets
Tick tubes around outdoor spaces
- PMID: 35777355, 36905473

60 "Never had a tick bite" "Not outdoorsy"

- Tick saliva contains an anesthetic
- Also anticoagulant and immunosuppressive substances
- Provides a localized environment at the site of the bite to evade detection — enhancing infection
- Soft-sided ticks (TBRF) are "snackers" — may self-detach and find new host, won't necessarily engorge
- Migratory birds carry ticks anywhere the bird can go
(even Home depot)

61 Covid

- Tweezer removal method.

- YouTube & <https://dr crist a.com/2018-5-26-lyme-the-best-way-to-remove-a-tick/>

62 Covid

- Tweezer removal method.
- YouTube & <https://dr crist a.com/2018-5-26-lyme-the-best-way-to-remove-a-tick/>

63 Covid

- Tweezer removal method.
- YouTube & <https://dr crist a.com/2018-5-26-lyme-the-best-way-to-remove-a-tick/>

64 Tick bite management

- Save the tick - moistened paper towel inside ziploc x 2. Freezer.
- Treat bite area (tick feces) - andrographis tincture (Dr. Chesney), povidone iodine.
- Snap a pic of the bite area immediately and then every day after for 10days.
- Histamine reaction vs EM rash ~
EM has increased erythema at farthest edge from bite
Either may expand irregularly
Called "Erythema migrans" not "erythema in scopum" (target)
so "migration" is the unique feature
- Submit tick for testing - algorithm.

65 Covid

- Tweezer removal method.
- YouTube & <https://dr crist a.com/2018-5-26-lyme-the-best-way-to-remove-a-tick/>

66 Acute Borrelia spp "Lyme"

- Onset from 1 day to 1 month after bite.
- Tick saliva induces migration of Borrelia into the blood stream, and out of stationary phase.
- * if symptomatic at day 1, consider a possible reactivated persistent Borreliosis, treat as acute Lyme+
- Influenza-like illness ~
Low-grade fever (co-infxn higher), headache, stiff neck, malaise/lethargy, joint pn, muscle pn, localized L/A
- Sick within a day, also consider:
Powassan virus - transmitted in 15 minutes
Anaplasma/ehrlichia

67 Early disseminated

- Onset weeks to months after bite.
- Early disseminated Lyme can occur even if no acute sxs.
- Areas ~
HT - carditis, A-V block
Neurological - cranial/peripheral neuropathy
M/S - migratory arthralgias
Eye - all the "itis"s - uveitis keynote, retinal tears
Skin/lymphatics
Liver/kidney - LFTs, proteinuria

68 Late or "chronic" Lyme

- Onset months to years after tick bite.

- Can also occur w/o any prior sx.
- Dr. Horowitz's Lyme/MSIDS Questionnaire is the premiere sx list.
- May have never felt well since, or triggered by stressor (mold, MVA, surgery, dental, mental/emotional, pregnancy, puberty, menopause, etc)
- Correlated with extreme morbidity.
- Chronic progressive multisystem illness in:
 - M/S
 - Neuro
 - Skin - acrodermatitis chronica atrophicans (European)
 - Hormone

69 Non-Lyme Borrelia - TBRF

- Tick-borne relapsing fever
- Transmission - soft-sided ticks (don't engorge, they "snack" and may move hosts,) lice, fleas, possible spider bites
- Tests negative on Lyme disease tests.
-
-

70 In Children - Early Lyme

- Early Lyme disease:
 - Fever
 - Fatigue
 - Flu-like illness, including achiness and malaise
 - Headache
 - Stiff neck
 - Swollen lymph nodes

Swollen lymph nodes

Weakness or numbness in one side of face, or develops paralysis

Spreading red rash or target rash (less than half of cases)

Muscle and/or joint pain that migrates around the body

Swollen joints

Carditis or inflammation of the heart

•

71 In Children: Early TBRF

- Early Tickborne Relapsing Fever:
 - High fever, chills
 - Headache
 - Muscle and joint aches
 - Fever relapses and lasts for about 3 days
 - Rarely a rash

72 In Children - Persistent/Chronic Borrelia

- Persistent or chronic Lyme disease or Tickborne Relapsing Fever:
 - Fatigue
 - Brain fog
 - Problems remembering new learning
 - Child avoids play or friends
 - Mood changes, depression, anxiety
 - Insomnia
 - Headaches
 - Frequently changing vision
 - Rashes that come and go
 - Nerve pain, numbness, tingling, or random hot or cold feeling
 - Heart palpitations
 - Digestive problems
 - Muscle and/or joint pain that migrates around the body

Frequent musculoskeletal injuries
Generalized heightened body pain

73 Covid

- Tweezer removal method.
- YouTube & <https://drchrista.com/2018-5-26-lyme-the-best-way-to-remove-a-tick/>

74 Understanding Symptoms

- Borrelia OSPs bind to the glycosaminoglycan (GAG) chains of host proteoglycans, binding promotes tissue colonization
- Gravitates to ECM and other areas rich in GAG nutrients ~
Endothelial glycocalyx
Tubules of the teeth (peg teeth = congenital)
Eyes
Joints
Cardiac nerve bundles
CNS
Neuromuscular junctions (fibromyalgia TPs, congenital atonia)
GB
- Migrates (as seen in rash)
- Unilateral (ie: Bell's palsy)
- PMID: 29116038

75 Take-Aways

- "Lyme" has become an umbrella term used to describe many iterations of tick-borne infections
 - different infections/combinations of infections
 - different stages/states
- 2-tier reflex to WB missing an inordinate number of cases

- ER/Urgent care labs too early to detect
- Clinical diagnosis is sufficient to initiate Tx
- Known tick bite is not required to Dx
- Rash is not required to Dx
- Tx for 7-10 days is not sufficient
- Delayed onset of Tx is correlated to worse outcomes
- "Post treatment Lyme syndrome" is an erroneous Dx. IME culprit is surviving bacteria, but is blamed on the immune system gone awry
- "Antibiotic refractory" - a research term - IME from undertreated and/or missed acute Dz → widely disseminated, genetically savvy bacteria (more later)
- Reportable Dz - if they'll accept it (my story of Advanced Labs culture +)
- Vertical transmission has been reported, positive cord blood and culture positive neonate

76 Borrelia Testing

- Culture-enhanced PCR
- Draw between 2-4pm - better chance of catching migrating spirochete
- Alternate for suppressed pt: provocation with deep tissue massage from immediately prior to up to ~4-6 hrs before draw
- Off ALL antimicrobials (including herbal) of all kinds for the culture to be reliable (one dose GSE turned negative)
- Itraconazole will affect this test. It acts on an ergosterol biosynthesis pathway that Borrelia uses to defend itself.
- Food-based antifungals in small amounts are likely okay, but be cautious of the stronger ones that also work

against bacteria such as garlic, onions, thyme, oregano.

-

77 Borrelia Testing

- Immunoblot > WB
Band 31 highly correlated with autoimmune sequelae
- T-cell - best choice for hypogammaglobulinemia pts but limited by the strains tested, and potentially weaker reaction to Borrelia than co-infections.
- Phage -
Good for immunocompromised patients (hypogam+mold reduced T-cell)
Reactive for bacteria (Borrelia), not nec for parasites (Babesia)
- Provoke with Lyme Nosode ~
10 drops under tongue daily, 2wks prior
Administer away from anything by mouth for 15 minutes before and after the dose
- *Reminder - positive test NOT required for Dx or Tx

78 Encephalitis Viruses

- Predilection for the brain
- Can induce neuroinflammation even with mild infections
- Flare may occur weeks after infection

79 Covid

- Early antigen (EA) - add-on
- Chronic/reactivated pattern ~
VCA-IgG - pos
VCA-IgM - neg

vCA-IgM - neg

EA-IgG - pos

EBV-NA - highly pos

(if 3-4x positive, consider chronic/reactivated)

- vs Past infection pattern ~
EA - neg
NA - lower pos

80 Influenza

- Very commonly reported cause of PANS and flares by parents.
- Influenza symptoms:
 - Fatigue
 - Fever
 - Chills
 - Cough
 - Sore throat
 - Runny or stuffy nose
 - muscle or body aches
 - Headaches
 - Less commonly, vomiting and diarrhea
- Monitor for secondary bacterial infections - sinus, ear, lung, pneumonia
- If child is reporting fever sxs with no rise in temp ~
Concern for CDR1, innate immunodeficiency (mold/NK cell fxn)
Increased risk factor for autoimmune activity

81 Mold mycotoxin exposure makes flu worse

- Increase viral replication SIV

•

82 Mycotoxin exposure makes flu worse

82 Mycotoxin exposure makes HIV worse

- Low level exposure ~
- Promotes infection
- Increases inflammatory responses
- Immune organ damage
- Induce a switch in alveolar macrophage polarization from M1 to M2
- Confer poorer outcomes in SIV-infected in mice

83 SARS-CoV-2

- Multiple entry routes into the brain - olfactory bulb, thalamus, and brain stem may be infected through a trans-synaptic transfer of the virus. Additional vagal nerve delivery via dendritic cells.
- Induces release of chemokines, cytokines, and inflammatory signals to the BBB and infects the astrocytes, which causes neuroinflammation and neuron death; neurodegenerative implications.
- Pathogenic effect on the CNS with specific impact on the midbrain dopamine neurons which abundantly express ACE-2 receptors.
- Spike protein can reach different brain regions, irrespective of viral brain replication. Can itself cause BBB dysfunction and damage neurons either directly, or via activation of brain mast cells and microglia and the release of various neuroinflammatory molecules.
- Spike protein alters microglial purinergic signaling in vitro, may potentiate the Cell Danger Response.
- Published case report examined adolescents who acutely developed new OCD, neuropsychiatric, and motor dysfunction symptoms consistent with PANS, having a temporal correlation, 2 weeks after a diagnosis of Covid-19.

- "Highly likely that neural autoantibody production is facilitated by SARS-CoV-2 infection..."
- PMID: 35601258, 36899824, 33158605, 33936086, 37114062, 37606433, 35883527, 33748620, 35390636

84 Cytokine cascade

- Entry in the brain via ACE2 (abundantly expressed in midbrain.)
- TLR or NF- κ B signaling activate the pro-inflammatory self-defense inflammasome after viral attachment.
- Pro-inflammatory feedback loop activates CNS immune cells, astrocytes and microglia, which induce IL-1, IL-6, TNF- α , and IL-8.
- Several CNS-related illnesses are linked with elevated levels of these inflammatory cytokines.

85 Neurotoxic components

- "Superantigenic" neurotoxin-like motif exhibits a high tendency to bind T-cell receptors.
- PMID: 32989130 (Oct 2020)

86 Periodontal infections

- A major under-recognized contributor to PANDAS/PANS and neuroinflammation.
- ID via qPCR Next-Generation Sequencing. Also tests for resistance in strains.
- Dentist or periodontist collects a small amount of fluid from an infected pocket in the gums, as well as a saliva

sample.

- Avoid ozone for 1 week prior to sample collection as it's a potent antimicrobial.
- Treatments using ozone are well-tolerated by P/P ~
Multiple published case studies using ozone gas to treat "untreatable" periodontal conditions (3-4 month nightly rinse.)
Some evidence (15-day trial) ozone rinse is not as effective against gingivitis as commonly used chemicals (chlorhexidine) but is a viable alternative for chemically-sensitive. Need a longer duration study - empirically quite effective.
- PMID: 36570588, 32594645

87 Infectious triggers

- Group A Beta-Hemolytic Streptococcus Pyogenes
- Mycoplasma pneumonia
- Chlamydia pneumonia
- Bartonella species
- Borrelia species (Lyme and Tickborne Relapsing Fever [TBRF])
- Encephalitis viruses
- Influenza
- SARS-CoV-2
- Periodontal

88 Diagnostics

- Clinical diagnosis

Clinical diagnosis

- PE and symptoms as clues
- General diagnostics
- Infectious triggers
- Environmental triggers

89 Environmental triggers

- Top 7 from my clinical practice ~
 - 1. Herbicides
 - 2. Mold
 - 3. EMFs
 - 4. Mercury
 - 5. Pesticides
 - 6. Vaccine adjuvants
 - (Food dyes get a dis-honorable mention)
- Commonality? All are neurotoxins and immunotoxins.

90 Glyphosate (Roundup)

- Genetically modify crops to be "roundup ready".
- Allows the GM plant to survive the mechanism of the chemical.
- But not just for killing weeds anymore!
- Additionally used as a desiccant for non-GMO grains, spraying enough to kill the greenery via desiccation for easier harvest of grains, equating to higher than approved levels just before harvest.
- Increases incidence of Fusarium mold infestation in storage.
- "Coherent and compelling evidence that glyphosate and glyphosate-based formulations are a cause of non-Hodgkin lymphoma (NHL) in humans exposed to these agents."
- Successful legal case linking exposure to NHL resulted in it being quietly taken off the market for residential use.
- Commercial use allowed to continue!
- PMID: 34052177, 31342895

91 No human effects?

- Affects shikimate pathway - not found in human cells but is utilized by our gut microbiome
- Reduces gut immunity and confuses the definition of "self", increasing the incidence of autoimmunity via Th17 and mast cell infiltration
- Salmonella and Clostridia are resistant to it
- Glyphosate-induced intestinal dysbiosis impacts CNS, in emotional, neurological and neurodegenerative disorders
- In mice, low-level "subchronic" exposure increased anxiety and depressive-like behaviors
- Low-level exposure linked to autism spectrum disorder

- Animal studies, low-level maternal glyphosate exposure linked to increased incidence of ASD
- PMID: 31442459, 29635013, 20012598, 28848410, 32398374

92 Glycine backbone

- Core of the molecule is glycine
∴ may displace glycine metabolically
- Impacts ~
Neurotransmitter (calming NT)
Glutathione (one of the AAs)
Glycine membrane channels (leading to channelopathies)
- Possible fertility impacts ~
alters testicular morphology and testosterone levels

93 Glyphosate urine test

- Urine

94 Atrazine - "pre-emergent" herbicide

- Endocrine disrupting chemical with neuroendocrine/epigenetic toxicity.
- Targets hypothalamus-pituitary-gonadal (HPG) axis.
- Frogs: low exposure males become females, high exposure males can procreate.
- Evidence of crosstalk between systems affected by Atrazine exposure, causing widespread dysfunction and leading to changes in behavior, even with no direct link to the hypothalamus.
- EU banned Atrazine use in 2003 recognizing the health risks of Atrazine exposure as a public health concern with no way to contain contamination of drinking water

no way to contain contamination of drinking water.

- Yet, the US recently reapproved Atrazine's use in the fall of 2020.
- PMID: 27413107, 35410624
-

95 Atrazine

- Histological and morphological alterations in the ovaries and testes are observed; dependent on duration of exposure and dose.
- Green = increases
- Pink = reductions
- Grey indicates that both increases and reductions are reported
- Effects in males are in purple
- Alterations in females are in red (VO: vaginal opening)
- PMID: 28713818

96 Atrazine

- Abundance of DRs → dysfunction of dopaminergic systems → ↑anxiety/anxiety-like behavior
- Might destruction of DRs be a compensatory reaction to Atrazine exposure?
- PMID: 34564358

97 Atrazine urine test

- Urine

98 Glyphosate urine test

- Urine

99 MOLD

- Natural function of fungi is to compost and recycle
- Excrete 1° and 2° metabolites ~ inhaled, ingested, and dermally absorbed
- 1° metabolites ~ necessary for survival aldehydes, alcohols, odors, digestive enzymes, and structural elements (ie: beta-glucans)
- 2° metabolites ~ competitive antimicrobials, mycotoxins (energetically expensive for the mold to make)

100 Mold is tenacious

- Moisture ~ 1° element for growth, 2° is organic substrate
- Obvious or visible water not necessary
- Relative humidity above 50% promotes growth
- Grows on WD surface within 24-48 hours
- Difficult to kill ~ any intact spore is dormant, not dead (a dead spore is a fragment)

- Spore formation and release increases more when drying than when wet (survival of species)

101 More than "spore illness"

- Spores
 - IgE | Allergic rhinitis, asthma, hypersensitivity pneumonitis (CDC)
 - Non-IgE | Non-IgE mediated Asthma exacerbation (CDC)
 - Infection | Aspergillosis (CDC)
 - Mast cell | Recruitment, degranulation, enhanced survival
- Fragments
 - "Mold-othelioma"
- Other Mould Dangers
 - Chemicals | VOCs, aldehydes, alcohols, MPA
 - Mycotoxins | Colonization
- Biofilm
 - Water-damage=increased microbial diversity (ie: actinomycetes, endotoxin)
 - Quorum behavior
- PMID: 24368325, 20537281, 24368325, 23710148

102 Respiratory system vs Mold

- Mould
- Spores-
- Cladosporium 3-5 μ m
- Aspergillus 2-5 μ m
- Penicillium 1-5 μ m

- Penicillium 1-5m
- Fragments-
- 1-2m
- Mycotoxins-
- 0.1m

103 Mycotoxins

- Aflatoxin
 - Aspergillus flavus, A. parasiticus
- Chaetoglobosin A,C
 - Chaetomium globosum
- Citrinin
- Aspergillus, Penicillium, Monascus
- Enniatin B1
 - Fusarium spp
- Gliotoxin
 - Aspergillus fumigatus, Candida spp
- Ochratoxin A
 - A. ochraceus, A. niger, Penicillium verrucosum, P. nordicum, P. chrysogenum

- Patulin
- Aspergillus spp, Penicillium spp, Mucor, Fusarium spp
- Sterigmatocystin
 - Precursor of Aflatoxin, A. versicolor
- Trichothecenes (Roridin, Verrucaridin, Nivalenol, Deoxynivalenol, Diacetoxyscirpenol, Satratoxin)
 - Stachybotrys chartarum, Trichoderma viride, Fusarium spp, Myrothecium
- Zearalenone
 - Fusarium spp

104 Respiratory system vs Mold

- Mould
- Spores-
 - Cladosporium 3-5 m
 - Aspergillus 2-5 m
 - Penicillium 1-5 m
- Fragments-
 - 1-2 m
- Mycotoxins-
 - 0.1 m

105 Mycotoxin health impacts summarized

- *Lipophilic*
- Immunotoxic
- Neurotoxic
- Alimentary toxic
- Dermatotoxic
- Nephrotoxic
- Hepatotoxic
- Hepatocarcinogenic
- Genotoxic
- Teratogenic
- Carcinogenic
- PMID: 26474839, 27178040, 25449202,12221236, 26600019

106 Mold

- Mycotoxins have a long history of use as a biological warfare weapon.
- "Yellow rain" T-2 toxin use against the Hmong people in Southeast Asia.
- So, yes, they affect everyone.

107 Multisystem Multisymptom

- More common than not that each person in an exposure environment has a completely different presentation.

- Every living being is affected.
- Depends on type of mould, presence of mycotoxins, duration and dose of exposure, and individual susceptibility.

108 Mold

- Use book

109 Mold

- Use book

110 Mold

- Use book

111 Mold

- Use book

112 Research Study

- Use book

113 Mold

- Use book

114 What Explains Symptom Persistence?

- Occupational studies ~
Coin flip: ~50/50 persister/recovered
Do they stay symptomatic out of the building?
*likely different stats for home exposure
- CES study ~

- CFS Study -

Normal controls: +fungus, -mycotoxins

CFS pts from WDB: +fungus, +mycotoxins

- Damp or WDB exposure is the key
- Mould is the trigger
- Colonization is the result
- PMID: 23580077 Brewer et al, Detection of mycotoxins in patients with chronic fatigue syndrome

115 Mold Assessments

- Lab -
- VCS
- mold spore allergy (can be normal and still have mold-related illness)
- Mycotoxin antibody
- Mycotoxin urine

116 Electrosmog

- Book

117 eEMFs

- Electromagnetic frequency radiation (external) - the invisible toxin of our time.
- Emitted from mobile phones, Wi-Fi, Bluetooth devices, smart meters, microwave ovens, many electrical devices, power and transmission lines, and wiring problems involving bad grounding.
- Thermal effects: increase BBB permeability to macromolecules.
- Main action is non-thermal via voltage-gated ion channels leading to channelopathies: oxidative stress, sperm/

testicular damage, neuropsych effects including EEG changes, apoptosis, cellular DNA damage, endocrine changes, and calcium overload.

- Behavioral studies have particularly concentrated on the effects of eEMFs on learning, memory, anxiety, and locomotion.
- Study in adolescents: change in memory performance over 1 year was strongly negatively associated with eEMF dose.
- PMID: 26474271, 31463749, 20550949, 29573716, 26300312

118 Voltage-gated channelopathies

- Synaptic vesicles in the presynaptic terminal contain a high density of voltage-gated Ca²⁺ channels.
- When an action potential arrives at the distal end of the axon – the presynaptic terminals – the inrush of positive charge activates voltage-sensitive Ca²⁺ channels.
- Ca²⁺ entry then initiates the release of NTs into the synaptic cleft.
- When NTs, such as ACh or glutamate, activate cation (for example Na⁺ or Ca²⁺) channels, and are thus depolarizing, they can be described as excitatory.
- PMID: 15753022

119 eEMFs

- Signs ~
EEG changes consistent with voltage-gated calcium channel activation
- Symptoms ~
Sleep disturbance/insomnia
Headache
Depression/depressive svmptoms

Depression, depressive symptoms
Fatigue/tiredness
Dysesthesia
Concentration/attention dysfunction
Memory changes
Dizziness
Irritability
Loss of appetite/body weight
Restlessness/anxiety
Nausea
Skin burning/tingling/dermographism

120 Screen reliance

- Only safe space for many P/P kids is virtual spaces
- Virtual school often required
- Screen addiction common (dopamine)
- eEMF Blocking ~
Lap pads, sleep canopies
- eEMF Grounding ~
Nature!, grounding mats
- eEMF Discharging ~
Movement (produces non-polarized internal or iEMFs)

121 eEMF Diagnostics

- Test spaces, no known "body" test at this time.
- Guard sleep space the most.

- Resources:
- Building Biology Institute (buildingbiologyinstitute.org)
- EMF Analysis (emfanalysis.com)
- Environmental Health Trust (ehtrust.org)
- Physicians for Safe Technology (mdsafetech.org)
- Tech Wellness (techwellness.com)
- *Beware of over-reliance on EMF protection gadgets. Reduction of exposure is the best mitigation measure.
-

122 Mercury

- WHO March 2017 ~
 - Considered by WHO as 1 of the top 10 chemicals or groups of chemicals of major public health concern.
 - Even small exposure amounts may cause serious health problems, and is a threat to the development of the child in utero and early in life.
 - May have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes.
- Comparison of typical exposures versus regulatory safety standards suggests that many people receive unsafe exposures.
- 1 in 6 women have mercury levels high enough to create a neurologic risk for their children.
- Norway was the first country that banned the use of mercury in all products in 2008 including dental amalgam, followed by Sweden and Denmark.

- 2018: the EU banned the use of dental amalgam for children under 15 and for pregnant/nursing women.
- PMID: 34941760, 24420334

123 Mercury sources

- Organic ~
Methylmercury - fish/water contamination from coal-fired power plants
Ethylmercury (Thimerosal) - vaccine adjuvant, preservative (ie: contact lens solutions)
- Inorganic/elemental ~
-“Silver” dental amalgams (about 50% mercury).
-Dentists like its malleability and hardness as compared to other materials.
-Continuously release elemental mercury vapor.
-Amalgam surface area that exceeds the safe level of airborne mercury in the intraoral cavity:
 Adult: >0.8 surface of a tooth
 Child: >0.6 surface of a tooth
- ∴ more than one small filling is harmful to a child's health
- PMID: 21782213, 34941760

124 Mercury sources

- Average amalgam filling - 1000mg
- Thermometers - 500mg
- Barometers
- Electronics
 LCD screens/monitors
 Laptop screen shutoffs

- Antiques; jewelry, clocks, glass/mirrors
- Old appliances & vehicle switches
- Medical
 - Preservative - eye, nasal, skin, injections
 - Skin ointments (hemorrhoid cream)
 - Antiseptics (Mercurochrome)
 - Pharmaceuticals (diuretics)
 - BP cuffs
- Some batteries
- Fluorescent lightbulbs - 4mg
- Food ~
 - Seafood: 1 can tuna - 15-60 mcg
 - High-fructose corn syrup
- Flu shot - 25 mcg per 0.5-mL dose

125 Dental mercury amalgams in children

- Evidence of safety of dental mercury amalgams in children has been based on 2 key studies from 2006 known as the Children's Amalgam Trials; followed >500 children each over 5/7 years.
- Both studies found no difference in neurobehavioral outcomes between the amalgam group and the composite (non-amalgam) group—although in both trials the amalgam group showed a statistically significant increase in urinary mercury levels

amalgam mercury levels.

- These two studies, in addition to being widely cited in the literature, are cited by the FDA and the ADA as providing evidence for the safety of amalgam.
- However, a 2011 reanalysis suggests harm, and >boys with common genetic variants.
 - Reanalysis used an exposure metric based on amalgam size and years of exposure
 - Found a significant association between amalgam and the porphyrin biomarkers for mercury-related enzyme blockage
- "Dental amalgams are a significant chronic contributor to mercury body burden."
- PMID: 24420334, 21053054

126 Dental amalgams disperse

- Mercury doesn't stay in the tooth!
- A study quantifying the excretion and distribution of mercury in biological samples after dental amalgams found ~
 - Concentrations of Hg in the biological samples of those with amalgams were found 6-8 times higher than the non-amalgam users (control).
 - Spike in Hg in RBCs, plasma, and urine on 1st day of filling, but not in hair or nails.
 - Accumulation in hair and nails by day 12, but reduced in RBCs, plasma, and urine.
- Mercury levels in the blood, urine or other biomarkers do not reflect the mercury load in critical organs.
- Gestational mercury exposure ~
 - Gestational exposure in infants of mothers who did not consume fish, had an elevated risk of URIs requiring a doctor visit.
 - Alterations in both T cells and gene expression in placenta at birth.
- Amalgams continuously release elemental mercury vapor (up to 20 micrograms per day.)
Odorless and tasteless.
Primarily absorbed in lungs where it can disperse widely, even xBBB.

- PMID: 27464660, 30743244, 34129869

127 Exposure estimates

- Organic mercury is more genotoxic than inorganic/elemental, yet "Amalgam-related Hg exposure [which is inorganic/elemental form] exceeds that from fish or other sources for the majority of the population."
- The highest allowable average mercury concentration in fish per serving when eating 1 serving per week = 0.46 µg/g
- Whereas, estimates of Hg exposure from amalgam fillings "based on the least conservative of the scenarios evaluated, it was estimated that some 67.2 million Americans would exceed the Hg dose associated with the reference exposure level (REL) of 0.3 µg/cubic meter of air established by the EPA."
- Exposure estimates are consistent with previous estimates presented by Health Canada, and amount to 0.2-0.4 µg/day per amalgam-filled tooth surface, or 0.5-1 µg/day per amalgam-filled tooth, depending on age/other factors.
- PMID: 21782213, 34941760

128 Dentists and dental hygienists

- Study of dentists in Iran found that the mean of the mercury level in the urine, nail, and blood was higher than the standard of the WHO.
- "So, in accordance with Article 10 of the European Union Regulations (EUR), in the context of the Minamata Convention (MC) on Dental Amalgam (DA), in order to avoid the dangers of mercury exposure in dentists, it is necessary for Iran and other countries to approve laws and to implement a national plan to reduce mercury levels and replace the appropriate materials."

- “Numerous studies have reported neurobehavioural effects in dental personnel occupationally exposed to chronic low levels of mercury (Hg).”
 - elevation of amyloid protein expression, deterioration of microtubules and increase or inhibition of transmitter release at motor nerve terminal endings.
 - neurodegenerative diseases such as Alzheimer’s, MS and mood disorders.
 - idiopathic disturbances in motor functions, cognitive skills and affective reactions.
- PMID: 33312669, 30589214

129 Amalgams vs fish

- Reference Dose of safety - level of exposure that is reasonably certain to be without appreciable risk for a population exposed over a long period of time.
- EPA set RfD for methylmercury consumption in women of childbearing age (and their fetuses). No other population of defined, not even children.
Reference Dose = 0.1 mcg/kg/day methylmercury. [45 lb child = 2 mcg/day]
- Amount of elemental mercury vapor from one amalgam filling =
1 surface = up to 20 mcg/day.
The lower the body weight, the more increased the concentration.
- “Throughout the world, efforts are underway to phase down or eliminate the use of mercury dental amalgam.” (PMID 24420334) Yet there are no RfDs set for amalgams in the US, not even for those with lower body weight.
- *I acknowledge this is comparing different forms of mercury

- I acknowledge this is comparing different forms of mercury and so may have different health/absorption/accumulation effects

130 Mercury health impacts

- Neuro ~
As vapor: can xBBB and lipid cell membranes, and can be accumulated into the cells in its inorganic forms.
Methylmercury can xBBB and placental barriers, causing serious damage in the CNS.
Animal studies: motor and cognitive impairment and neural loss.
- Nephrotoxic.
- Oral microbiome ~
Marked differences in the composition of the oral microbiome, associated with dental decay, found with even low concentrations of salivary mercury.
- Gut ~
Gut connection to neurotoxicity: Healthy intestinal microbiota demethylates MeHg and promotes excretion through feces.
But in so doing, it impacts the gut microbiota and metabolites related to gut-brain interactions.
Induces changes of intestinal microbial community structure which induces changes to regulating neuron activity.
Elemental Hg induces archaea (methanogens) conversion to methylmercury in vitro.
- PMID: 29777524, 32887894, 31918252, 33242089

131 Mercury, mast cells, and histamine

- Mercury induces histamine release from basophils.
- Mercury induces inflammatory mediator release from mast cells, specifically VEGF and IL-6.
- Animal models:
Induces a Th-2-dominated autoimmune syndrome with tissue injury in the form of a vasculitis and arthritis.
Sensitizes mast cells for mediator release and interleukin-4 expression.

Impacts mast cell survival.

- Links to autoimmunity, disruption to BBB and subsequent neuroinflammation.
- PMID: 20222982, 11222498, 19604304, 22103852, 9492216

132 Oral galvanism

- Electromotive forces and electrical currents discharged from a tooth when two or more dissimilar metals coexist in the mouth (i.e. as used to make the "amalgam".)
- Interact with salivary electrolytes, worse acidic saliva.
- Also occurs with contact between occluding metallic restorations.
- Can be measured (biological dentist): the threshold for pathological values of 5 microA for galvanic currents and 100 mV for galvanic voltage.
- A long-lasting influence (>15 hours) of galvanism can, in sensitive and genetically susceptible individuals, influence lymphocyte proliferation and surface molecule expression.
- "After removal of the electro-active restorations, both the contents of metals in saliva and galvanic currents decreased in comparison with the levels before the treatment."
- German study concluded that the removal of dental amalgam leads to "the permanent improvement of various chronic complaints in a relevant number of patients in various trials."
- PMID: 14917837, 15789284, 19178813, 15451237, 16804514

133 Mercury s/sxs

- Symptoms are variable and nonspecific. Neuropsych sxs have high cross-over with P/P.
- Poor resistance to infection, especially to yeast and yeast overgrowths.
- Anxiety, depression, "mercurial mood", irritability, suspicious, impulsive
- Memory problems, incoordination, movement abnormalities, a sense of internal vibration, paresthesias particularly of the hands and feet