Psychological Manifestations of Microbial Infections:

A Case for the Inclusion of Pediatric Autoimmune Neuropsychiatric Disorder Associated with Streptococcal Infections (PANDAS) & Chronic Lyme Disease

Presented by: Haley Walker
Advisor: Dr. John Lovell
## Toxoplasmosis, Syphilis, Lyme Disease, & PANDAS

### Similarities
- Microbial infections
- Anyone can be affected
- Acute, flu-like symptoms present
- Human reservoirs

### Differences
- Ability to cause psychological deficits?
- Ability to cross the blood-brain-barrier?
- Diagnosable
- Treatable
Centers for Disease Control and Prevention

Health promotion, disease prevention, and preparedness

Mission: “Work 24/7 to protect America from health, safety, and security threats, both foreign and in the U.S.”

Emerging Infectious Disease (EID) Journal

National Notifiable Diseases Surveillance System (NNDSS)
Blood-Brain-Barrier

- Main regulator of movement of substances from the blood into the brain
- 3 interfaces
- Tight barriers
  - Physical
  - Transport
  - Metabolic

Hey! We want in!

I'm sorry, but you are too highly charged, too large and not lipid soluble. You cannot enter the brain!

To the brain
Neuroinflammation

- CNS has separate immune system
- Microglia activated
  - Cytokine production
  - Blood-brain-barrier dysfunction
    - Increased permeability
    - Massive cellular infiltration
- Delayed leukocytic recruitment
- Closely linked with multiple degenerative pathways
Microbial Infections

- Caused by microscopic infectious agents: pathogens
  - Bacteria, fungi, parasites
- 4 stages:
  - Incubation
  - Prodromal
  - Acute
  - Convalescence
### Overview
- Single-celled protozoan
- Sexual versus asexual life cycles
- Cats = definitive host
- Mammals & birds = intermediate hosts

### Who’s at Risk?
- Infants born to infected mothers
- Organ transplant
- Weakened immune system
- Chemotherapy

### Transmission
- Raw or undercooked meat
- Contaminated water
- Cat’s litter box
- Mother-to-child
- Infected organ or blood
Toxoplasmosis

Acute Toxoplasmosis
- None
- 10-20% flu-like symptoms
- Types:
  - Congenital
  - Ocular
  - Immunocompromised patients

Chronic Toxoplasmosis
- Schizophrenia
- Severe psychiatric disorders
- Parkinson’s disease
- Alzheimer’s disease
Treponema pallidum

**Overview**
- Spirochete
- Microaerophilic
- Obligate internal parasite
- Asexual life cycle
- Host = humans

**Who’s at Risk**
- Infants born to infected mothers
- Individuals having unprotected sex
- Gay men
- HIV/AIDS patients

**Transmission**
- Mother-to-child
- Direct contact with sore
- Vaginal/anal/oral sex
- Blood transfusions
Syphilis

**Acute Syphilis**
- Types
  - Congenital
  - Ocular
  - HIV
- 3 Acute stages
  - Primary
  - Secondary
  - Early latent

**Latent Syphilis**
- 2 Chronic Stages
  - Late latent
  - Tertiary
    - Neurosyphilis
<table>
<thead>
<tr>
<th>Overview</th>
<th>Who’s at Risk?</th>
<th>Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Spirochete</td>
<td>10 Everyone</td>
<td>10 Mother-to-child</td>
</tr>
<tr>
<td>10 Natural cycle of infection by ticks</td>
<td>10 Spending time in wooded or grassy areas</td>
<td>10 Infected tick bite</td>
</tr>
<tr>
<td>10 Reservoir = small mammals and birds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Other hosts = <em>Ixodes</em> ticks and humans</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lyme Disease

**Acute Symptoms**
- Erythema migrans
  - Painless
  - Itchy
- Flu-like symptoms
  - Fever
  - Chills
  - Fatigue
  - Body aches

**Chronic Symptoms**
- Spread of erythema migrans
- Joint pain
- Meningitis
- Bell’s palsy
- Neuropathy
- Impaired memory
- Impaired muscle movement
- Heart rhythm irregularities
Streptococcus pyogenes

Overview
- Chain cocci
- Opportunistic life cycle
- Reservoir = humans

Who’s at Risk?
- Everyone
- Children aged 5-15
- Men

Transmission
- Person-to-person
- Respiratory droplets
- Direct contact with nasal secretions
PANDAS

Acute Symptoms: Pharyngitis
- Inflammation of the throat/pharynx
- Red and white patches
- Enlarged tonsils
- Flu-like symptoms
- 7-10 days

Chronic Symptoms: PANDAS
- Abrupt onset of:
  - OCD behaviors
  - Motor/verbal tics
- ADHD
- Separation anxiety
- Bedwetting
- Sleep disturbances
- Changes in motor skills and mood
Toxoplasmosis, Syphilis, Lyme Disease, & PANDAS

**Similarities**
- Microbial infections
- Anyone can be affected
- Acute, flu-like symptoms present
- Human reservoirs
- Ability to cause neurological deficits
- Ability to cross blood-brain-barrier

**Differences**
- Diagnosable
- Treatable


References


References


- What is inflammation? WebMD. (n.d.) Retrieved from https://www.webmd.com/arthritis/about-inflammation#1

Future Research

- Interviews/surveys:
  - Patients
  - Doctors
  - CDC employees
Inflammation

- Automatic immune response
- 4 major steps:
  - Vasodilation, vascular permeability, exudation, vascular stasis
- 4 cardinal signs:
  - Heat, edema, redness, pain
- White blood cells
- Begins immediately after injury