

Microbiology of the peripheral nervous system

Human immunodeficiency virus(HIV)

- A retrovirus that is transmitted primarily by sexual contact and contaminated blood.
- Affects both the CNS and the PNS.
- **Early in disease:** Inflammatory demyelinating polyneuropathy, mononeuropathy multiplex, and polyradiculopathies .
- **Advanced infection: Distal symmetric polyneuropathy (DSP):** the most common PNS complaint, it's called gloves & stockings distribution, it's caused by virus toxicity & neurotoxicity of cART (combination antiretroviral therapy).

Herpes viruses

- Relatively large, double-stranded, linear DNA genomes.
- Alpha herpesvirus infections initiate at peripheral sites(mucosal epithelia) → viral particles enter at the termini of sensory neurons PNS → transported along axons in the retrograde direction towards cell bodies → genomes are deposited in the nucleus → lifelong latency
- Infections spread → in the anterograde direction back out towards the Periphery.
→ Trans -neuronally, from PNS to CNS → lethal encephalitis.
- **Latency:** in the sensory nerve ganglia.
 1. Herpes simplex viruses I(HSV I) → orofacial lesions
 2. Herpes simplex viruses II(HSV II) → genitalia lesions
 3. Varicella-zoster virus (VZV):
 - Starts as varicella (chicken pox) which usually happens in childhood → latency in the sensory ganglia → sometimes it comes back as zoster (shingles) which is rash distributed according to the virus dermatomal distribution (areas that are supplied by sensory sensation from certain nerves)
 - **Post-herpetic neuralgia (PHN):** chronic neuropathic pain condition that persists 3 months or more following an outbreak of shingles.
 - **Multiple types of pain:** constant deep, aching, or burning pain; a paroxysmal, lancinating pain; hyperalgesia (painful stimuli are more painful than expected; and allodynia (pain associated with typically non-painful stimuli).
 - **Treatment of PHN:** acyclovir (DECREASE the period of PHN), alpha-2 delta ligands (gabapentin and pregabalin), other anticonvulsants (carbamazepine), tricyclic antidepressants (amitriptyline, nortriptyline, doxepin), topical analgesics (5 % lidocaine patch, capsaicin) tramadol, or other opioids.

Poliovirus

- A member of the enterovirus family causes polio or infantile paralysis.
- Fecal-oral transmission. • 72% : asymptomatic • < 1% : flaccid paralysis
- **Diagnosis:** stool, or through rising antibody titre in blood.

Borrelia burgdorferi

- Gram-negative rods that can't be viewed by a brightfield microscope or a gram stain which is why we use darkfield microscopy
- **Lyme disease**, the multisystem infectious disease caused by the tick-borne spirochete *Borrelia burgdorferi*, causes cranial neuropathies, painful radiculopathies, diffuse polyneuropathies, and skin rash (**erythema migrans**)
- Doxycycline is given to adults with suspected Lyme disease.

Clostridium tetani

- Spore-forming, anaerobic, Gram positive rod .
- *C. tetani* produces tetanospasmin that inactivates proteins that regulate release of the inhibitory neurotransmitters glycine and gamma-aminobutyric acid (GABA)
→ **Spastic paralysis** → sardonic smile
→ trismus or lockjaw
- Admission to the ICU is highly recommended. The patient should be in a quiet room with low traffic.
- Human tetanus immune globulin IVIg should be given as soon as tetanus is suspected .
- Antimicrobial therapy is typically metronidazole as the preferred treatment for tetanus with penicillin G as an option for **second-line therapy** with a treatment duration of 1 week to 10 days.
- Antimicrobial therapy plays a relatively minor role in the management of tetanus and of primary importance is wound debridement and toxin mitigation.

Clostridium botulinum



- Spore-forming, anaerobic, Gram positive rod.
- Causes Bilateral **descending weakness** of the peripheral muscles → **flaccid paralysis** → respiratory paralysis → death
 - Infant botulism: Associated with consumption of foods (e.g., honey, infant milk powder) contaminated with botulinum spores. In contrast with foodborne botulism, this disease is caused by neurotoxin .
 - The botulinum neurotoxin remains at the neuromuscular junction, The botulinum endopeptidase then inactivates the proteins that regulate release of acetylcholine, blocking neurotransmission at peripheral cholinergic synapses
→ **flaccid paralysis**.

- Don't feed honey to children younger than 12 months because it has been linked to some cases of infant botulism.

Campylobacter jejuni

- Curved, microaerophilic, gram-negative rods.
- A common cause of bacterial gastroenteritis. Infections are zoonotic (mainly contaminated poultry) & self-limiting.
- **Guillain-Barré syndrome (GBS)**: immune-mediated demyelinating polyneuropathy of PNS characterized by acute or subacute symmetrical **ascending motor weakness**, areflexia, and mild-to-moderate sensory abnormalities.
- Molecular mimicry between **sialylated lipooligosaccharide** structures on the cell envelope of these bacteria and **ganglioside** epitopes on the human nerves that generates cross-reactive immune response results in autoimmune-driven nerve damage.
- **Treatments**: plasma exchange and intravenous immunoglobulin (IVIg) >> are indicated for patients who are unable to walk independently while corticosteroids are largely ineffective in GBS.

Mycobacterium leprae

- **Leprosy (Hansen's disease)** 
 - ↳ causes nontraumatic peripheral neuropathy
 - ↳ transmitted by respiratory droplets
- The causative agent, *Mycobacterium leprae*, has a predilection for Schwann cells 
 - ↳ destruction of myelin, secondary inflammatory changes, and destruction of the nerve architecture.
- **Symptoms**: hypopigmented or hyperpigmented skin macules that exhibit loss of sensation (anesthesia).
- *M. leprae* is morphologically indistinguishable from *M. tuberculosis*.
- The diagnosis is confirmed by skin or nerve biopsy and acid-fast staining.
- **Treatment**: multidrug therapy (MDT).