

Chapter 22 Microbial Diseases of the Nervous System

The Nervous System

- Meninges protect brain and spinal cord
 - Dura mater: Outermost layer
 - Arachnoid mater: Middle layer
- Subarachnoid space contains cerebrospinal fluid (CSF)
 - Pia mater: Innermost layer
- Blood–brain barrier
- Meningitis: Inflammation of meninges
- Encephalitis: Inflammation of the brain
- Meningoencephalitis: Inflammation of both

Bacterial Meningitis

- Initial symptoms of fever, headache, and stiff neck
- Followed by nausea and vomiting
- May progress to convulsions and coma
- Diagnosis by Gram stain and latex agglutination of CSF
- Treatment: Cephalosporins, vancomycin

Haemophilus influenzae Meningitis

- Occurs mostly in children (6 months to 4 years)
- Gram-negative aerobic bacteria, normal throat microbiota
- Capsule antigen type b
- Prevented by Hib vaccine

Neisseria Meningitis

- Also called meningococcal meningitis
- Caused by *N. meningitidis*
 - Gram-negative, aerobic cocci with a capsule
- 10% of people are healthy nasopharyngeal carriers
- Begins as throat infection, rash
- Serotypes B, C, Y, W-135 in U.S.
- Serotype B in Europe
- Serotype A in Africa, China, and Middle East
- Vaccination (B, C, Y, W-135 capsule) recommended for college students

Streptococcus pneumoniae Meningitis

- Also called pneumococcal meningitis
- Caused by *S. pneumoniae* (a gram-positive diplococcus)
- 70% of people are healthy nasopharyngeal carriers

- Most common in children (1 month to 4 years)
- Mortality: 30% in children, 80% in elderly
- Prevented by vaccination

Listeriosis

- Caused by *Listeria monocytogenes*
- Gram-negative aerobic rod
- Usually foodborne; it can be transmitted to fetus
- Reproduce in phagocytes

Tetanus

- Caused by *Clostridium tetani*
- Gram-positive, endospore-forming, obligate anaerobe
- Grows in deep wounds
- Tetanospasmin released from dead cells blocks relaxation pathway in muscles
- Prevention by vaccination with tetanus toxoid (DTP) and booster (dT)
- Treatment with tetanus immune globulin

Botulism

- Caused by *Clostridium botulinum*
- Gram-positive, endospore-forming, obligate anaerobe
- Intoxication comes from ingesting botulinum toxin
- Botulinum toxin blocks release of neurotransmitter, causing flaccid paralysis
- Prevention
 - Proper canning
 - Nitrites prevent endospore germination in sausages
- Treatment: Supportive care and antitoxin
- Infant botulism results from *C. botulinum* growing in intestines
- Wound botulism results from growth of *C. botulinum* in wounds

Leprosy

- Also called Hansen's disease
- Caused by *Mycobacterium leprae*
- Acid-fast rod that grows best at 30°C.
- Grows in peripheral nerves and skin cells
- Transmission requires prolonged contact with an infected person
- Tuberculoid (neural) form: Loss of sensation in skin areas; positive lepromin test

Chapter 22

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- Lepromatous (progressive) form:
Disfiguring nodules over body; negative lepromin test

Poliomyelitis (Polio)

- Poliovirus
- Transmitted by ingestion
- Initial symptoms: Sore throat and nausea
- Viremia may occur; if persistent, virus can enter the CNS
- Destruction of motor cells and paralysis occurs in <1% of cases
- Prevention: vaccination (enhanced-inactivated polio vaccine)

Rabies

- Caused by the rabies virus
- Transmitted by animal bite
- Furious rabies: Animals are restless then highly excitable
- Paralytic rabies: Animals seem unaware of surroundings

Rabies Virus

- Virus multiplies in skeletal muscles and then brain cells, causing encephalitis
- Initial symptoms may include muscle spasms of the mouth and pharynx and hydrophobia

Prevention of Rabies

- Preexposure prophylaxis: Injection of human diploid cells vaccine (HDCV)
- Postexposure treatment: Vaccine plus rabies immune globulin (RIG)