

# Chapter 26 Nervous System Infections

## Summary Outline

- 26.1 Infectious agents can reach the **central nervous system (CNS)** via the **bloodstream**, via the **cytoplasm of nerve cell axons** and by **direct extension through bone**.
- 26.2 **Bacterial diseases of the nervous system**
- Bacteria can infect the **brain, spinal cord** and **peripheral nerves**, but more commonly they infect the **meninges** and **cerebrospinal fluid**, causing **meningitis**.
  - Bacterial meningitis is uncommon** and **most victims are children**. In most, but not all victims, the causative bacterium is one commonly found among the **normal upper respiratory flora** of healthy people. *Haemophilus influenzae* was once the leading cause of childhood bacterial meningitis, but it is now mostly controlled by a **vaccine**.
  - Meningococcal meningitis** is caused by *Neisseria meningitidis*, can result in **shock** and **death** and can occur in **both childhood and adult epidemics**. Symptoms are **cold-like** and are followed by **abrupt onset of fever, severe headache, pain and stiffness of the neck and back, nausea, and vomiting**. **Small hemorrhages** into the skin, **deafness**, and **coma** can occur. **Shock** results from the **release of endotoxin** into the bloodstream.
  - Listeriosis** is caused by *Listeria monocytogenes*, a non spore-forming Gram-positive rod. It is a **food-borne illness** often manifest as **meningitis** in newborn infants and others. The bacterium is **widespread**, commonly contaminates foods such as **unpasteurized milk, cold cuts** and **soft cheeses**, and **can grow in the refrigerator**.
  - Leprosy (Hansen's disease)** is characterized by invasion of peripheral nerves by the **acid-fast bacillus**, *Mycobacterium leprae*, which **has not been cultivated in vitro**. The disease occurs in **two main forms** depending on the immune status of the patient (1) **Tuberculoid** and (2) **Lepromatous**.
  - Botulism** is an often fatal type of **food poisoning** that causes severe **generalized paralysis**. The causative bacterium, *Clostridium botulinum*, is an anaerobic Gram-positive rod that **forms heat-resistant spores** that survive canning or other heat-treatment of foods. The spores germinate and the bacteria multiply and release a powerful toxin into the food. **Wound botulism**, caused when *C botulinum*, **colonizes dirty wounds** containing dead tissue, is **rare**.
- 26.3 **Viral diseases of the nervous system**
- Most viral nervous system infections are caused by **human enteroviruses** or by the **viruses of certain zoonoses**, but other viruses can **cause infectious mononucleosis, mumps, measles, chickenpox** and **herpes simplex** (cold sores, genital herpes).
  - Viral meningitis** is much **more common** than bacterial meningitis. It is **generally a mild disease** for which there is **no specific treatment**.
  - Viral encephalitis** has a **high fatality rate** and often leaves survivors with permanent disabilities. It can be **sporadic or epidemic**. **Herpes simplex virus** is the most important cause of sporadic encephalitis. **Epidemic encephalitis** is usually caused by **arboviruses**. **LaCrosse encephalitis virus**, maintained in *Aedes* mosquitoes and squirrels and chipmunks, is usually the **most frequently reported**.
  - Poliomyelitis** causes **destruction of motor nerve cells** of the brain and spinal cord leading to **paralysis, muscle wasting** and **failure of normal bone development**.
  - Rabies** is a **widespread zoonosis** transmitted to humans mainly through the **bite of an infected animal**. Once symptoms appear in an infected human being the disease is **almost uniformly fatal**. Because of the **long incubation period, prompt immunization** with **inactivated vaccine** begun after a rabid animal bite is effective in preventing the disease. **Passive immunization** given at the same time increases the protection.

26.4 **Fungal disease of the nervous system**

- A. **Fungi rarely invade the nervous system of healthy people**, but they can be a **threat to the life of individuals with underlying diseases** such as **diabetes, cancer** and **immunodeficiency**. Treatment of these infections is usually very difficult.
- B. **Cryptococcal meningoencephalitis** originates in the lung after a person inhales dust laden with *Filobasidiella (Cryptococcus) neoformans*, **encapsulated yeast**, which **resists phagocytosis** because of its large capsule. The organism is **associated** with soil contaminated with **pigeon droppings**.

26.5 **Protozoan diseases of the nervous system**

- A. **Only a few** free-living protozoa infect the human nervous system.
- B. **African sleeping sickness** is caused by *Trypanosoma brucei* and transmitted by the **tsetse fly**. It is a major health problem in **equatorial Africa**. The late stages of the disease are marked by **indifference, sleepiness, coma** and **death**.

26.6 **Transmissible spongiform encephalopathies**

- A. There are a group of rare diseases that cause a sponge-like appearance of the brain tissue due to the loss of neurons.
- B. An animal example is mad cow disease.
- C. Creutzfeld-Jakob disease is a human example.
- D. These diseases are caused by prions that are naked infectious pieces of protein.