Poliovirus

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Disease/Etiologic Agent: Poliomyelitis, commonly known as polio, is an infectious viral disease caused by the genus *Enterovirus* from the *Picornaviridae* family.[1] Poliomyelitis is a paralytic disease resulting from the destruction of motor neurons in the central nervous system and can lead to partial or full paralysis.[(7)(5)] There are three forms of polio infections: sub-clinical, non-paralytic, and paralytic.[2]

1. **Sub-clinical**: The most common polio infection form is sub-clinical, which accounts for approximately 95 percent of all cases. Sub-clinical infected individuals typically are asymptomatic and does not affect the central nervous system.
2. **Non-paralytic**: This form causes mild symptoms and does not result in paralysis. However, it does affect the central nervous system. This form makes up 1-5 percent of all polio cases.[6]
3. **Paralytic**: Known as the rarest and most serious form of polio, it causes full or partial paralysis in affected individuals. Within this form, there are three types of paralysis that can occur: spinal polio (affects the spine), bubar polio (affects the brainstem, and bulbospinal polio (affects both the spine and brainstem). This form occurs in 0.1-2 percent of cases.[6]

There is a condition called post-polio syndrome that can occur when an infected person has recovered from poliovirus and symptoms appear 35 years after.[2]

Transmission: Polio is very contagious and infectious disease that only infects humans. Its mean of transmission is person-to-person contact. Polio portal of entry into the body is via oral-fecal route, although oral-oral route may account for some cases.[(3)(1)] Transmission can also occur in areas of poor sanitation, where there are contaminated water and food.[4]

Reservoirs: Humans are the only known carrier of the virus.[1] Often, infected individuals have the sub-clinical form that is asymptomatic. Therefore, those that are infected do not know that they have the virus and spread it.

General Characteristics of Polio:

Structure: The poliovirus is a small (22 to 33 nm), single-stranded (approximately 7,500 nucelotides), positive sense RNA virus enclosed in a non-enveloped icosahedral protein capsid.[9] The virus can survive in an acidic pH environment[10], like the gastrointestinal tract. There are three serotypes of poliovirus: PV1, PV2, and PV3.[7] Generally, immunity to one serotype does not mean immunity to other serotypes.[1]

Key tests for identification: A stool or pharynx sample from the infected person is the most common way to identify the virus. Cerebrospinal fluid could also be used by

measuring the increased number of white blood cells (10-200 cells/mm3. To confirm, a serology test is used.[1]

Signs and symptoms of disease: Initial symptoms of nonparalytic polio include fever, fatigue, sore throat, headache, vomiting, pain in limbs, and stiffness in the neck.[3] Paralytic polio symptoms start off similiarly to nonparalytic symptoms, but within a week, paralytic symptoms such as loss of reflexes, severe muscle aches or weakness and flaccid paralysis on one side of the body occur. Post-polio syndrome symptoms are progressive muscle or joint weakness and pain, fatigue and exhaustion after minimal activity, muscle atrophy, difficulty with breathing and swallowing, sleep apnea, intolerance of cold temperatures, concentration and memory difficulties, depression and mood swings.[4] Incubation ranges from 5 - 35 days (average 7 - 14 days).[5] However, most people do not develop symptoms.

Historical information: Evidence of polymyelitis can be traced back to Ancient Egypt[(all 13)]

- 1789—British physician Michael Underwood records the first clinical description
- 1894—In Vermont, the first outbreak of polio epidemic in the US occurs, with 132 cases.
- 1908—Scientists Karl Landsteiner and Erwin Popper are the first to identify a virus as the causative agent of polio through experiments of transmission to a monkey
- 1916—Another polio epidemic occurs in the US
- 1921—Franklin D. Roosevelt is diagnosed with polio at the age of 39. He inadvertently becomes the face of polio and helped change public perception on the disease.
- 1930s—three strains of poliovirus are discovered
- 1953—Dr. Jonas Salk and his associates develop an inactivated polio vaccine.
- 1955-1957—U.S. polio incidence declines by 85-90 percent.
- 1979—The last case of wild type polio in the US reported.
- 1980s—Post-polio syndrome identified by physicians
- 1981—Publication of Poliovirus genome sequence
- 1999—Inactivated polio vaccine replaces oral polio vaccine as the recommended form of polio immunization in the US.

Virulence factors: The virus enters the human body through the mouth and nose. Once inside the human body, it begins replication in the throat and intestines.[5] Poliovirus use immunoglobulin-like molecules as their receptors for recognizing and entering host cells.[7] The cellular receptor, CD155 is on the host's motor neurons; this allows for the virus to attach to the cell and for entry of the virus's genome to occur.[7] Once the virus attaches, it "injects" its viral RNA into the host cell. Once inside the cell, the virus hijacks the cell's assembly process, particularly the host's ribosomes, and makes thousands of copies of itself.[8] The virus progeny causes cytolysis of the host's neuron cell and travels through the lymphatic system, where it then enters the bloodstream and is carried to the CNS.[8]

Control and Treatment: There is no specific course of treatment. The goal is to minimize and attempt to control the symptoms of the infection. Treatment includes breathing assistance, antibiotics for urinary tract infections, application of moist heat to reduce muscle pain and spasms, painkillers to reduce headaches, muscle pain and spasms, and physical therapy. Physical therapy can be corrective shoes or braces.[5]

Prevention and Vaccine: The best form of prevention is vaccination. There are two types of polio vaccines, inactivated polio vaccine (IPV) and oral polio vaccine (OPV). OPV is no longer used in the US[10], however it is used in the eradicate polio virus efforts of the WHO. In the US, it is recommended that children receive four doses of IPV between the ages of 2 months to 6 years old.[6] An IPV booster is given between the ages of 4 to 6 years old. IPV stimulates antibody production in the body. In addition, it is recommended to get vaccinated for polio if you plan to travel to Africa and Asia, where polio still exists.[6]

Local cases or outbreaks (with incidence figures): The last reported cases of poliomyelitis through endemic transmission in the US was 1979. The outbreak occurred in several Midwest states where the virus was introduced from the Netherlands.[1] From 1980 to 1999, a total of 152 cases (6 imported cases, 2 indeterminate, and 144 vaccine-associated paralytic polio) were reported. [1] The last imported case was in 1993. However, there have been two VAPP cases reported in the US in 2005 and 2009, respectively. More recently in San Antonio, TX, a 7-month-old infant that had just immigrated to the US, was seen in at a local hospital in early July 2013 for VAPP.[11]

Global cases or outbreaks (with incidence figures): WHO and CDC began a global polio eradication initiative in 1988. Worldwide polio cases have fallen from 350,000 in 1988 to 407 in 2013, marking a decline in reported cases to more than 99 percent. The Americas, Europe and South East Asia and Western Pacific have been certified as polio free. Currently, Afghanistan, Nigeria and Pakistan are the polio-endemic countries.[12]

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