Vaccine Associated Paralytic Polio

衛福部 疾病管制署
中區傳染病防治醫療網
王任賢 指揮官

Poliomyelitis

- First described by Michael Underwood in 1789
- First outbreak described in U.S. in 1843
- 21,000 paralytic cases reported in the United States in 1952
- Global eradication in near future

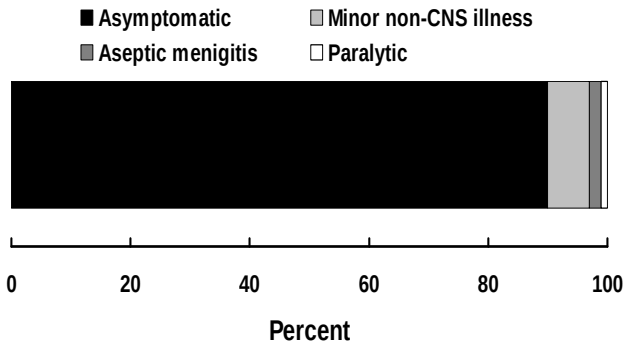
Poliovirus

- Enterovirus (RNA)
- Three serotypes: 1, 2, 3
- Minimal heterotypic immunity between serotypes
- Rapidly inactivated by heat, formaldehyde, chlorine, ultraviolet light

Poliomyelitis Pathogenesis

- Entry into mouth
- Replication in pharynx, GI tract, local lymphatics
- Hematologic spread to lymphatics and central nervous system
- Viral spread along nerve fibers
- Destruction of motor neurons

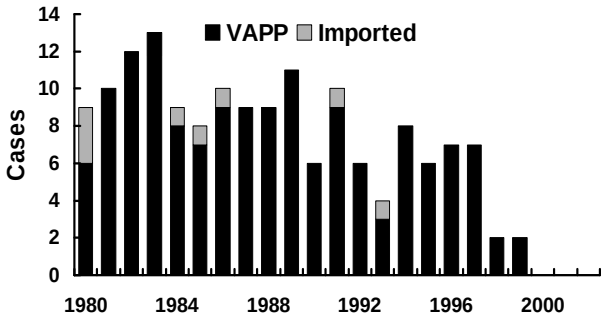
Outcomes of poliovirus infection



Poliovirus Epidemiology

- Reservoir — Human
- Transmission — Fecal-oral
  Oral-oral possible
- Communicability — 7-10 days before onset
  Virus present in stool
  3-6 weeks

Poliomyelitis – United States, 1980-2002



Poliovirus Vaccine

- 1955 Inactivated vaccine
- 1961 Types 1 and 2 monovalent OPV
- 1962 Type 3 monovalent OPV
- 1963 Trivalent OPV
- 1987 Enhanced IPV (IPV)

Inactivated Polio Vaccine

- Contains 3 serotypes of vaccine virus
- Grown on monkey kidney (Vero) cells
- Inactivated with formaldehyde
- Contains 2-phenoxyethanol, neomycin, streptomycin, polymyxin B

Oral Polio Vaccine

- Contains 3 serotypes of vaccine virus
- Grown on monkey kidney (Vero) cells
- Contains neomycin and streptomycin
- Shed in stool for up to 6 weeks following vaccination

Inactivated Polio Vaccine

- Highly effective in producing immunity to poliovirus
- >90% immune after 2 doses
- >99% immune after 3 doses
- Duration of immunity not known with certainty

Oral Polio Vaccine

- Highly effective in producing immunity to poliovirus
- 50% immune after 1 dose
- >95% immune after 3 doses
- Immunity probably life long

Schedules that Include Both IPV and OPV

- Only IPV is available in the United States
- Schedule begun with OPV should be completed with IPV
- Any combination of 4 doses of IPV and OPV by 5 years constitutes a complete series

Polio Vaccine Adverse Reactions

- Rare local reactions (IPV)
- No serious reactions to IPV have been documented
- Paralytic poliomyelitis (OPV)

Vaccine-Associated Paralytic Polio

- Increased risk in persons >18 years
- Increased risk in persons with immunodeficiency
- No procedure available for identifying persons at risk of paralytic disease
- Most cases in healthy children and their household contacts

Vaccine-Associated Paralytic Polio (VAPP) 1980-1998

• Healthy recipients of OPV	41%
• Healthy contacts of OPV recipients	31%
• Community acquired	5%
• Immunodeficient	24%

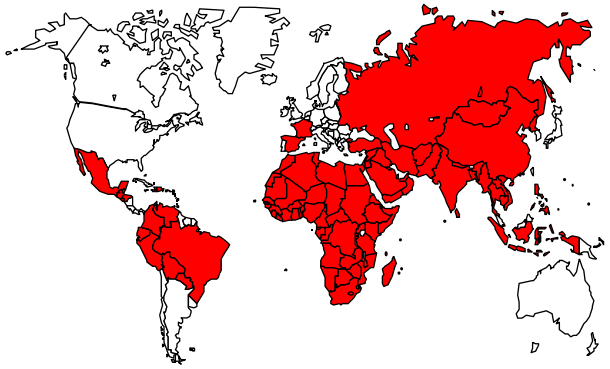
Polio Vaccine Contraindications and Precautions

- Severe allergic reaction to a vaccine component or following a prior dose of vaccine
- Moderate or severe acute illness

Polio Eradication

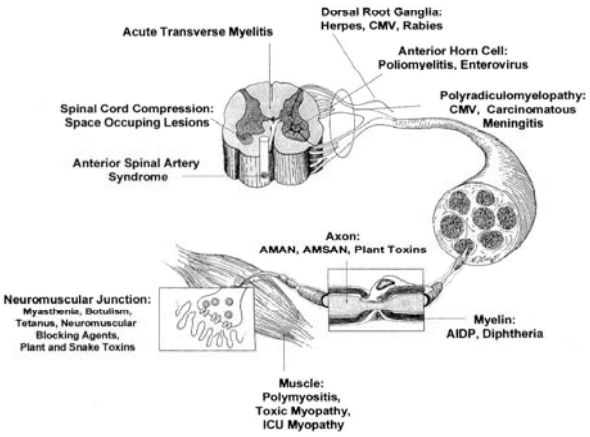
- Last case in United States in 1979
- Western Hemisphere certified polio free in 1994
- Global eradication goal by 2005

Wild Poliovirus 1988



Wild Poliovirus 2003

Differential diagnosis of AFP



Polioviruses

- Poliovirus type 1 has the highest ratio of paralytic infection to subclinical infection and is the most frequent cause of epidemics of paralytic disease.
- Poliovirus types 2 and 3 are less neurovirulent

Poliomyelitis is transmitted by:

- person-to-person spread through fecal-oral and oral-oral routes, or occasionally by a common vehicle (e.g., water, milk).

- The incubation period is typically 7-14 days (range, 3-35 days).
- When nonimmune persons are exposed to wild poliovirus, inapparent infection is the most frequent outcome .
- "Abortive poliomyelitis," also referred to as "minor illness," is the most frequent form of the disease.

- Nonparalytic poliomyelitis (including aseptic meningitis) occurs in 4 percent of patients.
- Only 1/1,000 to 1/100 infected individuals develop paralytic disease

- Initial clinical symptoms include fever, fatigue, headache, vomiting, constipation (or less commonly diarrhea), stiffness in the neck, and pain in the limbs.
- A biphasic course featuring these relatively nonspecific symptoms with acute onset of paralysis during the second phase is seen mostly in young children, and is uncommon in individuals over 15 years of age.

Distinguishing characteristics of paralytic poliomyelitis are:

1) fever at onset
2) rapid progression of paralysis within 24-48 hours
3) asymmetrical distribution of limb paralysis, affecting proximal limb muscles more than distal limb muscles
4) preservation of sensory nerve function with (often severe) myalgia
5) residual paralysis after 60

Paralytic poliomyelitis

- In early stage CSF polymorph leukocytes increase; however, these are replaced after 2-3 days by moderate numbers of lymphocytes and monocytes.
- The CSF protein is elevated only slightly, but it rises gradually in paralytic cases until the third week, generally returning to normal by the sixth week.
- Glucose levels are usually within the normal range

- Motor neuron cells expressing a specific receptor for poliovirus are susceptible to virus adherence and multiplication, leading to the subsequent destruction of motor neurons responsible for activating muscles.
- Anterior horn cell disease, including the appearance of inflammatory cells and motor neuron loss in the spinal cord, normally occurs within the first 2 weeks

- Affected nerve cells do not regenerate, which results in the inability of affected muscles to function; however, axonal sprouting may result in some recovery of function.
- Poliomyelitis may lead to severe asymmetrical atrophy and skeletal deformities.

Risk of paralytic polio

- Besides age, being unvaccinated or inadequately vaccinated, and lower socioeconomic status, several factors have been shown to increase the risk of acquiring paralytic manifestations, including intramuscular injections, infection, stress, strenuous exercise, surgery (e.g., tonsillectomy), trauma, and pregnancy.

Vaccine-associated paralytic poliomyelitis

- cases of vaccine-associated paralytic poliomyelitis (known as "the Cutter incident") were reported in association with the use of incompletely inactivated vaccine

- The Sabin-derived virus may occasionally revert to a neurovirulent strain, potentially causing paralytic illness that is clinically identical to poliomyelitis resulting from wild-type virus

- The overall risk of VAPP is one case per 2.5 million oral poliovirus vaccine doses

Three distinct groups are at risk of vaccine-associated disease

- Recipients of oral poliovirus vaccine (mostly infants receiving their first dose)
- Persons in contact with oral poliovirus vaccine recipients (mostly unvaccinated or inadequately vaccinated adults)
- Immunocompromised individuals However, neither HIV infection nor AIDS has been associated with an increased risk of paralytic disease due to wild-type or Sabin-derived poliovirus.

Nonpolio enteroviruses

- Nonpolio enteroviruses have been associated with polio-like paralytic disease, frequently accompanied by other clinical syndromes, such as
- aseptic meningitis
- hand-foot-mouth disease
- acute hemorrhagic conjunctivitis

The following have been implicated in polio-like paralytic disease

- Coxsackieviruses A and B
- Echovirus
- Enterovirus 70 and 71

Muscle weakness and wasting associated with enterovirus 70 is usually severe and permanent.

- Among all known nonpolio enteroviruses, enterovirus 71 has been most strongly implicated in outbreaks of central nervous system disease and AFP

Antecedent illness (7-14 days before onset of AFP) was generally characterized by fever, vomiting, diarrhea, lethargy, nuchal rigidity, irritability, and anorexia;

at 60-day follow-up, these patients suffered from residual paralysis with weakness and muscle wasting

- Nonpolio enterovirus infection may be clinically indistinguishable from paralytic poliomyelitis without laboratory studies

多謝聆聽