**Polio and Polio Vaccine**

Epidemiology and Prevention of Vaccine-Preventable Diseases

National Immunization Program
Centers for Disease Control and Prevention
Revised January 2006

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**Poliomyelitis**

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

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**Poliovirus**

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

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**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

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**Outcomes of poliovirus infection**

- Asymptomatic
- Minor non-CNS illness
- Aseptic menigitis
- Paralytic

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**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, 1950-2005**

- **Inactivated vaccine**
- **Live oral vaccine**
- **Last indigenous case**

**Poliomyelitis—United States, 1980-2005**

- VAPP
- Imported

**Poliovirus Vaccine**

- **1955**: Inactivated vaccine
- **1961**: Types 1 and 2 monovalent OPV
- **1962**: Type 3 monovalent OPV
- **1963**: Trivalent OPV
- **1987**: Enhanced-potency 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 lifelong

Polio Vaccination Recommendations, 1996-1999
• Increased use of IPV (sequential IPV-OPV schedule) recommended in 1996
• Intended to reduce the risk of vaccine-associated paralytic polio (VAPP)
• Continued risk of VAPP for contacts of OPV recipients

Polio Vaccination Recommendations
• Exclusive use of IPV recommended in 2000
• OPV no longer routinely available in the United States
• Indigenous VAPP eliminated

Polio Vaccination Schedule

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
<th>Minimum Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 months</td>
<td>IPV</td>
<td>---</td>
</tr>
<tr>
<td>4 months</td>
<td>IPV</td>
<td>4 wks</td>
</tr>
<tr>
<td>6-18 months</td>
<td>IPV</td>
<td>4 wks</td>
</tr>
<tr>
<td>4-6 years*</td>
<td>IPV</td>
<td>4 wks</td>
</tr>
</tbody>
</table>

*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

*the fourth dose of IPV may be given as early as 18 weeks of age
Pediarix

• Contains IPV, DTaP, and hepatitis B vaccines
• Minimum age 6 weeks, maximum age 6 years
• Approved by FDA for first 3 doses of the IPV and DTaP series
• Not approved for booster doses

Polio Vaccination of Adults

• Routine vaccination of U.S. residents ≥18 years of age not necessary or recommended
• May consider vaccination of travelers to polio-endemic countries and selected laboratory workers

Polio Vaccination of Unvaccinated Adults

• IPV
• Use standard IPV schedule if possible (0, 1-2 months, 6-12 months)
• May separate doses by 4 weeks if accelerated schedule needed

Polio Vaccination of Previously Vaccinated Adults

• Previously complete series
  — administer one dose of IPV
• Incomplete series
  — administer remaining doses in series
  — no need to restart 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
• 5-10 cases per year with exclusive use of OPV
• 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
- Last isolate of type 2 poliovirus in India in October 1999
- Global eradication goal

**Wild Poliovirus 1988**

- Map of the world showing countries

**Wild Poliovirus 2004**

- Map of the world showing countries

**National Immunization Program**

**Contact Information**

- Telephone: 800.CDC.INFO
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