Poliomyelitis

Manitoba
Public Health Branch

1. Case Definition

1.1 Confirmed Case[&]: Clinical illness* with laboratory confirmation of infection:

- Isolation of poliovirus (vaccine or wild-type) from an appropriate clinical specimen (e.g., stool, respiratory specimens including endotracheal tube aspirate, nasopharyngeal aspirate or swab, CSF{cerebrospinal fluid}, autopsy material e.g., brain, spinal cord, intestinal contents)
  OR
- Detection of poliovirus RNA from an appropriate clinical specimen
  OR
- Clinical illness* in a person who is epidemiologically linked to a laboratory-confirmed case (1).

1.2 Probable Case: Clinical illness* without detection of poliovirus from an appropriate clinical specimen and without evidence of infection with other neurotropic viruses but with one of the following laboratory confirmations of infection:

- Significant rise (e.g., fourfold or greater) in polio IgG titre by any standard serologic assay between acute and convalescent sera
  OR
- Positive serologic test for polio IgM antibody in the absence of recent immunization with poliovirus-containing vaccine (1).

Note: Poliovirus serology is not offered at Cadham Provincial Laboratory but may be offered at some reference labs.

*Clinical illness: is characterized by all of the following:

- Acute flaccid paralysis (AFP) of one or more limbs
- Decreased or absent deep tendon reflexes in the affected limbs
- No sensory or cognitive loss
- No other apparent cause (including laboratory investigation to rule out other causes of a similar syndrome)
- Neurologic deficit present 60 days after onset of initial symptoms, unless the patient has died (1).

[&] Confirmed cases of poliomyelitis can be further subdivided into the following two categories:

1) Wild virus: Laboratory investigation implicates wild-type virus. This group is further subdivided as follows:

- Imported: Travel in or residence in a polio-endemic area 30 days or less before onset of symptoms.
- Import-related: Epidemiologic link to someone who has travelled in or resided in a polio-endemic area within 30 days of onset of symptoms.
- Originating in Canada: No travel or contact as described above (1).

2) Vaccine-associated virus: Laboratory investigation implicates vaccine-type virus. This group is further subdivided as follows:

- Recipient: The illness began 7-30 days after the patient received oral polio vaccine (OPV).
- Contact: The patient was shown to have been in contact with an OPV-recipient and became ill 7-60 days after the contact was vaccinated.
- Possible contact: The patient had no known direct contact with an OPV-recipient and no history of receiving OPV, but the paralysis occurred in an area in which a mass vaccination campaign using OPV had been in progress 7-60 days before the onset of paralysis.

- No known contact: The patient had no known contact with an OPV-recipient and no history of receiving OPV, and the paralysis occurred in an area where no routine or intensive OPV vaccination had been in progress. In Canada, this would include all provinces and territories (1).

2. Reporting and Other Requirements

Laboratory:

- All positive laboratory results for poliovirus are reportable to the Public Health Surveillance Unit by secure fax (204-948-3044). A phone report must be made to a Medical Officer of Health at 204-788-8666 on the **same day** the result is obtained, **in addition to** the standard reporting by fax.

Health Professional:

- Probable (clinical) cases of poliomyelitis are reportable to the Public Health Surveillance Unit by telephone (204-788-6736) during regular hours (8:30 a.m. to 4:30 p.m.) AND by secure fax (204-948-3044) on the **same day** that they are identified. After hours telephone reporting is to the Medical Officer of Health on call at (204-788-8666). The *Clinical Notification of Reportable Diseases and Conditions* form https://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0013.pdf should be used.
- Adverse events following immunization should be reported by health care professional by completing and returning the form available at: http://www.gov.mb.ca/health/publichealth/cdc/docs/aefi_form.pdf .

Regional Public Health or First Nations Inuit Health Branch (FNIHB):

- Once the case has been referred to Regional Public Health or FNIHB, the *Communicable Disease Control Investigation Form* https://www.gov.mb.ca/health/publichealth/cdc/protocol/mhsu_0002.pdf should be completed and returned to the Public Health Surveillance Unit by secure fax (204-948-3044).

3. Clinical Presentation/Natural History

The virus enters through the mouth, and primary multiplication occurs in the pharynx and gastrointestinal tract (2). The virus invades local lymphoid tissue, enters the bloodstream, and then may infect cells of the central nervous system (2). Replication of poliovirus in motor neurons of the anterior horn and brain stem results in cell destruction and causes the typical clinical manifestations of poliomyelitis (3). Infection with poliovirus results in a spectrum of clinical manifestations from inapparent infection to nonspecific febrile illness, aseptic meningitis, paralytic disease and death (3). Ninety to ninety-five percent of poliovirus infections are asymptomatic (4). In symptomatic persons, initial symptoms include fever, fatigue, headache and vomiting (4). Severe muscle pain and stiffness of the neck and back with or without paralysis may occur (4). Less than 1% of cases result in paralysis (4). The case fatality rate for paralytic polio is 2% to 5% among children and 15% to 30% for adults (4). Permanent weakness is observed in approximately two-thirds of patients with paralytic poliomyelitis (5). Aseptic meningitis occurs in about 1% of infections (6). Depending on the sites of paralysis, polio can be classified as spinal, bulbar, or spino-bulbar disease

(7). Bulbar paralysis can compromise respiration and swallowing (7). Paralysis of the respiration and/or swallowing muscles can be life-threatening (6). The most severe cases of poliomyelitis in terms of complications and fatal outcomes occur in persons with underlying immunodeficiency disorders (8). Poliomyelitis should be considered in the differential diagnosis of all cases of AFP, including Guillain-Barré syndrome and transverse myelitis (9).

Adults who had paralytic poliomyelitis during childhood may develop non-infectious post-polio syndrome 15 to 40 years later (10). Post-polio syndrome is characterized by slow and irreversible exacerbation of weakness often in those muscle groups involved during the original infection (10). Muscle and joint pain are also common manifestations (10).

4. Etiology

Polio is caused by poliovirus types 1, 2 and 3; members of the genus *Enterovirus* of the *Picornaviridae* family (4, 6). In 2015, type 2 (WPV2) was declared eradicated and type 3 WPV (WPV3) was last reported in November 2012 (11).

Paralytic polio also occurs in association with vaccination with live oral poliovirus vaccine (6). The vaccine polioviruses are able to replicate in the intestinal tracts of inadequately immunized persons and may be transmitted to others with inadequate immunity (3). The viruses may regain some of the properties of wild polioviruses, such as transmissibility and neurovirulence (3). Clinical disease caused by these vaccine-derived polioviruses is indistinguishable from that caused by wild polioviruses (3).

5. Epidemiology

5.1 Reservoir and Source:

Humans are the only natural host and reservoir of polioviruses (5), most frequently people with inapparent infections, especially children (6). Chronic carriage of vaccine-derived poliovirus has been reported, associated with primary immunodeficiency syndromes (6). Poliovirus is rapidly inactivated by heat, formaldehyde, chlorine and ultraviolet light (2).

5.2 Transmission:

Transmission of poliovirus occurs mainly through the fecal-oral route (4). The oral-oral transmission route is possible (2). Respiratory spread may rarely occur (4). Infected persons without symptoms shed virus in the stool and are able to transmit the virus to others (2). Poliovirus can survive outside the human body for weeks at room temperature (12).

5.3 Occurrence:

General: As of July 2018, three countries remain endemic for type 1 wild poliovirus (WPV1): Afghanistan, Nigeria and Pakistan (11). Outbreaks have been reported recently in the Democratic Republic of Congo, Kenya, Niger, Papua New Guinea, Somalia and Syria (13). In temperate climates, polio infection generally increases in the late summer and autumn months (4). In tropical areas, the seasonal pattern is less pronounced (10). When the Global Polio Eradication Initiative (GPEI) was founded in 1988, polio was endemic in more than 125 countries and paralyzed 350,000 children every year (14). Since then, the GPEI has overseen a 99% reduction in annual cases of polio (14). Poliomyelitis remains primarily a disease of infants and young children (6). In the three countries that have not yet succeeded in interrupting transmission, 80% to 90% of cases are in children younger than three years and

virtually all cases are in those younger than five years (6). In 2018, 33 cases of wild poliovirus were reported to the World Health Organization (21 from Afghanistan and 12 from Pakistan) and 104 cases of circulating vaccine-derived polioviruses (mainly from Nigeria, Papua, New Guinea and the Democratic Republic of the Congo) (15).

Canada: The last case of wild poliovirus originating in Canada (i.e., not imported or import-related) was reported in 1977 (16, 17). Paralytic poliomyelitis cases resulting from wild virus importations were reported in Canada in 1978 and 1988 (17). In 1994, Canada was certified as being free of the wild poliovirus by the World Health Organization (4). Most cases of paralytic polio from 1980 to 1995 were associated with OPV vaccine (4). The last nationally reported case of paralytic polio occurred in 1995, and was related to OPV receipt (4). National surveillance is ongoing for cases of AFP in children less than 15 years of age (16).

Manitoba: No cases of poliomyelitis have been reported in Manitoba since the current reporting system began in 1992.

5.4 Incubation:

The incubation period for polio is generally six to 20 days with a range of three to 35 days (4).

5.5 Host Susceptibility and Resistance:

Children less than five years of age are more susceptible to poliovirus infection (4). Infants born to immune mothers have transient passive immunity (6). IPV (inactivated poliovirus) vaccine appears to produce less local gastrointestinal immunity than does OPV, so persons who receive IPV are more readily infected with wild poliovirus than OPV recipients (2).

5.6 Risk Factors:

Individuals living in or travelling to endemic countries (i.e., Afghanistan, Nigeria, Pakistan) as well as neighbouring countries to where polio cases are being reported are at increased risk of polio (13). Using OPV or travelling to areas where it is used is a risk for vaccine-derived poliomyelitis as upon replication in recipients, the vaccine virus can revert to neurovirulence and cause vaccine associated paralytic polio (18). Undervaccinated populations are at continued risk for poliovirus spread on introduction of poliovirus into their communities (18). Risk factors for paralytic disease include larger inocula of poliovirus, increasing age, pregnancy, strenuous exercise, tonsillectomy, and intramuscular injections administered while the patient is infected with poliovirus (7).

5.7 Period of Communicability:

Communicability is greatest around the onset of illness when the virus is present in high concentrations in the throat and feces (4). Poliovirus can be shed in the feces for three to six weeks (4, 19). Poliovirus can be present in the throat for one to two weeks following immunization with OPV, and in the feces for several weeks after immunization with OPV (4). In rare cases, including immunocompromised persons, poliovirus (from natural infection or OPV vaccine) can be excreted for prolonged periods of time (from greater than 6 months to a number of years) (4, 11).

6. Diagnosis

Isolation of poliovirus constitutes a public health emergency. Poliovirus can be detected by respiratory specimens (endotracheal tube aspirate, nasopharyngeal aspirate or swab), gastrointestinal (stool), from CSF or autopsy material. All specimens should be sent in viral transport media to CPL using a CPL requisition. The testing

formats include viral culture, nucleic acid testing for poliovirus RNA and electron microscopy. Cultures or residual specimens are submitted to the National Microbiology Laboratory to determine if the virus is a wild-type or vaccine-associated strain. Please note, serology for poliovirus is not available.

7. Key Investigations for Public Health Response:

For Cases:

- Polio immunization status (total number of doses of oral and/or injection polio vaccine received).
- For wild poliovirus cases, determine the following:
    - Travel in or residence in a polio-endemic area 30 days or less before onset of symptoms;
    - Epidemiologic link to someone who has travelled in or resided in a polio-endemic area within 30 days of onset of symptoms in the case (1).
- For vaccine-associated poliovirus cases, determine the following:
    - If the illness began 7-30 days after the case received OPV;
    - If the case was shown to have been in contact with an OPV-recipient and became ill 7-60 days after the contact was vaccinated;
    - In the absence of OPV receipt and contact with an OPV recipient as described above, the case had been in an area in which a mass vaccination campaign using OPV had been in progress 7-60 days before the onset of paralysis (1).
- Identification of close contacts (refer to definition below under section 8.2).

8. Control

8.1 Management of Cases:

- Management is supportive and directed towards the relief of symptoms. For severe cases of paralysis, supportive measures to ensure airway patency, adequate respiratory effort and clearance of secretions are the mainstay of treatment (5).
- Referral to appropriate specialists for neurological investigation.
- Follow-up assessment of outcome of paralysis 60 days after its onset.

Infection Prevention and Control: Routine Practices and Contact Precautions. Refer to the Manitoba Health, Seniors and Active Living document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf .

Public Health Measures:

- Consider exclusion of cases who are food handlers or childcare workers until stool culture is negative.

8.2 Management of Close Contacts:

- **Definition of Close Contacts:**
    - Household contacts - Persons living in the same house or having close contact with the case (e.g., sharing sleeping arrangements or playing together for ≥ 4 hours) within 30 days before the case's onset of illness;
    - Attendees at the same child care facility as the case;
    - Persons having contact with stools or fecal matter of the case within 30 days before the case's onset of illness, without using infection control precautions (17).

- Symptomatic contacts should be referred to a physician for assessment.
- Review immunization status of all close contacts (17). Unimmunized or partially immunized contacts should have their poliovirus immunization updated as per recommendations in the current *Canadian Immunization Guide.*
- Consider stool specimen testing of asymptomatic close contacts of confirmed cases in consultation with the regional Medical Officer of Health.

8.3 Management of Outbreaks:

An outbreak is defined as the occurrence of case(s) in a particular area and period of time in excess of the expected number of cases. Since the last case of polio reported in Canada was in 1995, a single case of polio would be considered an outbreak.

- Detailed investigation and risk assessment (refer to section 7 above).
- Case and contact management as per sections 8.1 and 8.2 above.
- Enhanced surveillance for AFP to determine if there is evidence of person-to-person transmission (11).

8.4 Preventive Measures:

- Refer to the Manitoba Health, Seniors and Active Living document *Routine Practices and Additional Precautions: Preventing the Transmission of Infection in Health Care* http://www.gov.mb.ca/health/publichealth/cdc/docs/ipc/rpap.pdf for the management of infected or potentially infected patients in hospital.
- Immunization. Refer to the current *Canadian Immunization Guide* as well as the MHSAL immunization site https://www.gov.mb.ca/health/publichealth/cdc/div/index.html for recommended schedules and eligibility criteria.
- Active national surveillance of acute flaccid paralysis (AFP) (refer to https://www.canada.ca/en/public-health/services/surveillance/acute-flaccid-paralysis.html) in children < 15 years to screen for potential cases of poliomyelitis (17).
- Environmental surveillance (i.e., sampling sewage sites) in poliovirus endemic countries and other high risk areas to detect poliovirus importation and interrupt silent circulation before the development of poliomyelitis cases (19).

References

1. Public Health Agency of Canada. Case Definitions for Communicable Diseases under National Surveillance. *Canada Communicable Disease Report CCDR* 2009; 35S2: 1-123.

2. Centers for Disease Control and Prevention. Poliomyelitis. In: *The Pink Book: Epidemiology and Prevention of Vaccine-Preventable Diseases, 13th Edition 2015* https://www.cdc.gov/vaccines/pubs/pinkbook/polio.html .

3. Centers for Disease Control and Prevention National Centre for Immunization and Respiratory Diseases. VPD Surveillance Manual Chapter 12: Poliomyelitis https://www.cdc.gov/vaccines/pubs/surv-manual/chpt12-polio.html .

4. Government of Canada. Poliomyelitis Vaccine. *Canadian Immunization Guide* https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-17-poliomyelitis-vaccine.html .

5. Romero JR and Modlin JF. Poliovirus. In: Mandell, Douglas and Bennett's *Principles and Practice of Infectious Diseases 8th ed.* Elsevier, Philadelphia, 2015.

6. Heymann David L. Poliomyelitis (polioviral fever, infantile paralysis). In: *Control of Communicable Diseases Manual 20th ed*, American Public Health Association, Washington, 2014; 477-484.

7. Centers for Disease Control and Prevention. Poliomyelitis Prevention in the United States. *MMWR* 2000; 49(RR05): 1-22.

8. Sutter RW, Kew OM, Cochi SL and Aylward RB. Poliovirus vaccine--live. In: Plotkin SA, Orenstein WA, Offit PA, eds. *Vaccines* Sixth Edition. China: Elsevier Saunders Inc. 2013: 598-645.

9. American Academy of Pediatrics. Poliovirus Infections. In Pickering LK ed. *Redbook: 2012 Report of the Committee on Infectious Diseases 29th ed.* Elk Grove Village, IL: American Academy of Pediatrics, 2012; 588-592.

10. Centers for Disease Control and Prevention. Polio For Healthcare Professionals.

11. World Health Organization. Polio Global Eradication Initiative. Standard Operating Procedures: Responding to a Poliovirus Event or Outbreak, Version 3, January 2019.

12. Carnie JA, Lester R, Mann R et al. Public Health Response to Imported Case of Poliomyelitis, Australia, 2007. *Emerging Infectious Diseases* 2009; 15(11): 1733-37.

13. Government of Canada. Polio: vaccine advice. https://travel.gc.ca/travelling/health-safety/travel-health-notices/171 .

14. World Health Organization. Polio Global Eradication Initiative. Semi-Annual Status Report January to June 2018 Progress Against the Polio Eradication and Endgame Strategic Plan http://polioeradication.org/wp-content/uploads/2018/11/2018_January-June_SemiAnnualReport_POL_highresolution.pdf .

15. World Health Organization. Global Polio Eradication Initiative. Polio this week as of 17 April 2019.

16. Government of Canada. Poliomyelitis (Polio): For health professionals. https://www.canada.ca/en/public-health/services/diseases/poliomyelitis-polio/health-professionals.html

17. Buck P, Herman S, Scott C et al. Protocol for the Investigation of Acute Flaccid Paralysis and Suspected Paralytic Poliomyelitis. *Canada Communicable Disease Report* 1998; 24(4):25-32.

18. Alexander JP, Ehresmann K, Seward J et al. Transmission of Imported Vaccine-Derived Poliovirus in an Undervaccinated Community in Minnesota. *JID* 2009; 199:391-7.

19. Asghar H, Diop OM, Weldegebriel G et al. Environmental Surveillance for Polioviruses in Global Polio Eradication Initiative. *JID* 2014; 210(S1):S294-303.