Ministry of Health

Ontario Public Health Standards:
Requirements for Programs, Services and Accountability

Infectious Disease Protocol

Appendix 1: Case Definitions and Disease-Specific Information

Disease: Rabies

Effective: May 2022

Ontario

Rabies

☒ Communicable

☐ Virulent

Health Protection and Promotion Act (HPPA)

Ontario Regulation (O. Reg.) 135/18 (Designation of Diseases)

Provincial Reporting Requirements

☒ Confirmed case

☒ Probable case

As per Requirement #3 of the "Reporting of Infectious Diseases" section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- O. Reg. 569 (Reports) under the HPPA;[6]
- The iPHIS User Guides published by Public Health Ontario (PHO); and
- Bulletins and directives issued by PHO.

Type of Surveillance

Case-by-case

Case Definition

Confirmed Case

Laboratory confirmation of infection with clinically compatible signs and symptoms:

- Detection of viral antigen in an appropriate clinical specimen, preferably the brain or the nerves surrounding hair follicles in the nape of the neck, by immunofluorescence

OR

- Isolation of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue using cell culture or laboratory animal

OR

- Detection of rabies virus ribonucleic acid (RNA) in an appropriate clinical specimen (e.g., saliva)

Probable Case

Clinically compatible signs and symptoms with the following laboratory results:

- Demonstration of rabies-neutralizing antibody titre ≥ 0.5 IU/mL (i.e., complete neutralization) in the serum or CSF of an unvaccinated person

Outbreak Case Definition

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

Outbreak cases may be classified by levels of probability (*i.e.* confirmed and/or probable).

Clinical Information

Clinical Evidence

Clinically compatible signs and symptoms begin with a feeling of anxiety, cephalalgia, slightly elevated body temperature, malaise and indefinite sensory alterations, frequently around the site of the lesion. The excitation phase that follows is characterized by hyperesthesia, dilation of pupils and increased salivation. As the disease progresses swallowing dysfunction is seen in most patients and there may be spasms of the respiratory muscles and generalized convulsions. Rabies is an acute encephalomyelitis that almost always progresses to coma or death within 10 days after the first symptom.

Clinical Presentation

During the incubation period after exposure, the person does not experience disease symptoms and the wound from the bite may heal. The prodrome begins when the virus enters the peripheral nerves and spinal cord and can last 2 – 10 days. Onset of clinical symptoms is generally heralded by a sense of apprehension and excitability with headache, fever, malaise and indefinite sensory changes and pain at the site of the bite.[1] The excitation phase that follows is characterized by hypertension, increased salivation and swallowing dysfunction (hydrophobia). This may be followed by generalized paralysis.[3] The acute neurological phase of the disease is characterized by encephalomyelitis that almost always progresses to coma or death, often due to cardiac failure, if no medical intervention is given.[1]

Laboratory Evidence

Laboratory Confirmation

Any of the following will constitute a confirmed case of Rabies:

- Positive for rabies antigen
- Positive rabies virus culture
- Positive nucleic acid amplification test (NAAT) for rabies virus

Approved/Validated Tests

- Immunofluorescence test for rabies virus antigen
- Standard culture for rabies virus
- NAAT for rabies virus RNA
- Rabies virus neutralization test

Indications and Limitations

- Negative results do not rule out rabies infection because viral material may not be detectable (e.g., early in infection). CSF frequently remains negative.
- The presence of rabies virus-neutralizing antibodies can indicate an exposure to rabies virus antigen or passive immunization.

- Negative serological results do not rule out a rabies infection because antibody levels may not surpass the detection threshold (0.5 IU/mL) and seroconversion may occur very late during the course of infection.
- The sensitivity and specificity of serological tests may vary from laboratory to laboratory in spite of the application of international standards.
- Immunofluorescence test on unfixed brain tissue is the only recommended test for post-mortem diagnosis.

For further information about human diagnostic testing, contact the Public Health Ontario Laboratories.

Rabies is suggested by a history of animal exposure and or bite and confirmed by recovery of virus from saliva and salivary gland, cerebrospinal fluid or central nervous system tissue of an infected person. It can also be confirmed by direct immunofluorescence to detect viral antigen in brain tissue.[1,4]

Presumptive diagnosis may be based on serological tests.[2]

Case Management

In addition to the requirements set out in the Requirement #2 of the "Management of Infectious Diseases – Sporadic Cases" and "Investigation and Management of Infectious Diseases Outbreaks" sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection. Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

Investigate all persons exposed to potentially rabid animals to determine source of infection. Conduct risk assessment for rabies transmission and refer exposed persons to their health care provider. Provide rabies post-exposure prophylaxis to requesting physician if indicated.

Refer to the *Rabies Prevention and Control Protocol, 2020* (or as current), and for the management of persons exposed to potentially rabid animals.[7]

The following disease-specific information may also be obtained during the investigation:

- Determine the possible source including animal involved;
- Identify other persons and animals exposed to the source animal;
- Note the type of exposure (bite, scratch, or other);
- Note the geographic location of exposure, and
- Determine the immunization status of animal (if possible).

If the disease is traced to imported or domesticated animals, contact the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

For rabies cases, death is invariably the outcome once onset of clinical signs is evident.

Contact Management

In hospital, health care workers should be educated about the potential hazard of infection from saliva, and the use of personal protective equipment to avoid exposure.

If indicated, refer to the *Management of Potential Rabies Exposures Guideline, 2020* (or as current) document for post exposure prophylaxis information.[8]

Outbreak Management

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.

A single case of rabies in a person constitutes an outbreak and should be managed with urgency to identify other persons exposed to the same source or that came into contact with infected body fluids belonging to the case.

Prevention and Control Measures

Personal Prevention Measures

Preventative measures:[1]

- Avoid contact with stray, wild, sick, dead or strangely acting animals;

- Promote immunization of cats and dogs against rabies;
- Promote the reporting of aggressive animals, or animals that have bitten people, to the local board of health;
- Individuals who are at high risk of exposure such as veterinarians, wildlife and park personnel, or travellers to areas where rabies is endemic, should receive pre-exposure immunization;
- Individual people should not try to capture bats found in their house and should bat proof their homes; and
- Wash animal bite wounds immediately with soap and clean running water and seek medical attention promptly.

Infection Prevention and Control Strategies

Use routine practices for hospitalized cases for the duration of illness.[2]

Contact with salivary secretions or tears of a human case should be avoided, and immediate attendants responsible for the care of a human case should be warned of the potential hazard of infection from saliva.[1]

Refer to PHO's website to search for the most up-to-date information on Infection Prevention and Control (IPAC).

Disease Characteristics

Aetiologic Agent - Rabies disease is caused by the rabies virus; a ribonucleic acid (RNA) virus classified in the *Rhabdoviridae* family, from the genus *Lyssavirus*.[1,2]

Modes of Transmission - Rabies is primarily a disease of animals, but can be transmitted to humans through the saliva of infected animals through bites, scratches or other contact with either breaks in the skin or mucosal membranes.[4] Person to person transmission is theoretically possible but rare and not well documented.[1] Airborne spread has been demonstrated in caves where bats roost and in laboratory settings, but this occurs very rarely.[1] Transmission through transplantation of corneas, solid organs and blood vessels from undiagnosed human rabies cases has occurred.[1,2]

Incubation Period – Usually 3-8 weeks; very rarely as short as a few days or as long as several years.[1] The incubation period depends on wound severity, wound site in relation to nerve supply and distance from the brain, the amount and strain of virus, protection provided by clothing and other factors such as adequate wound cleansing.[1]

Period of Communicability - Rabid animals are infectious only from the time the virus reaches the salivary glands and up until death. Death in species other than rabies reservoir species usually occurs within one week of onset of clinical signs. Different species may shed virus in saliva for different lengths of time prior to onset of clinical signs. Defined periods of communicability in animal hosts are reliably known for domesticated dogs, cats and ferrets, which may shed virus in saliva for up to 10 days prior to the onset of clinical signs. Other mammals (including humans) may shed virus in saliva for up to 14 days prior to the onset of clinical signs.[1] Wildlife rabies reservoir species may shed virus for much longer periods of time, and are not considered to have a defined period of communicability.

Reservoir - Rabies is a disease of mammals, both domestic and wild. In Canada and the US, foxes, skunks, raccoons and bats may be reservoirs capable of transmitting infection to dogs, cats, livestock and people.[5] In Canada, the canine variant of rabies virus has been eliminated primarily through vaccination programs.[4]

Host Susceptibility and Resistance - All mammals are susceptible to rabies.[1]

Please refer to PHO's Reportable Disease Trends in Ontario reporting tool for the most up-to-date information on infectious disease trends in Ontario.

For additional national and international epidemiological information, please refer to the Public Health Agency of Canada and the World Health Organization.

References

1. Heymann DL, editor. Control of Communicable Diseases Manual. 20 ed. Washington, D.C: American Public Health Association; 2015.
2. Committee on Infectious Diseases, American Academy of Pediatrics. Section 3: Summaries of Infectious Diseases: Rabies. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, editors. Red Book: 2018 Report of the Committee on Infectious Diseases. 31 ed. Itasca, IL: American Academy of Pediatrics; 2018.
3. Acha P, Szyfres B. Zoonoses and Communicable Diseases Common to Man and Animals. Vol. 2. 3 ed. Washington, DC: Pan American Health Organization; 2003.
4. Government of Canada. Rabies [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2018 [updated March 8, 2018; cited July 23, 2018]. Available from: https://www.canada.ca/en/public-health/services/diseases/rabies.html
5. National Advisory Committee on Immunization, Public Health Agency of Canada. Part 4- Active Vaccines: Rabies Vaccine. 2015. In: Canadian Immunization Guide [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada, [cited July 23, 2018]. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-18-rabies-vaccine.html
6. Health Protection and Promotion Act, R.S.O. 1990, Reg. 569, Reports, (2018). Available from: https://www.ontario.ca/laws/regulation/900569
7. Ontario, Ministry of Health. Rabies Prevention and Control Protocol, 2020. Toronto, ON: Queen's Printer for Ontario; 2020. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/Rabies_Prevention_and_Control_Protocol_2020.pdf

8. Ontario, Ministry of Health. Management of Potential Rabies Exposures Guideline, 2020. Toronto, ON: Queen's Printer for Ontario; 2020. Available from: https://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/Mgt_of_Potential_Rabies_Exposures_2020.pdf

Case Definition Sources

Acha P, Szyfres B. Zoonoses and Communicable Diseases Common to Man and Animals. Vol. 2. 3 ed. Washington, DC: Pan American Health Organization; 2003.

Centers for Disease Control and Prevention. National Notifiable Disease Surveillance System: Rabies, Human - 2011 Case Definition [Internet]. Atlanta, GA: U.S. Department of Health & Human Services; 2011. Available from: https://www.cdc.gov/rabies/index.html

Heymann DL, editor. Control of Communicable Diseases Manual. 20 ed. Washington, D.C: American Public Health Association; 2015.

Public Health Agency of Canada. Rabies. In: Case Definitions for Communicable Diseases under National Surveillance. Canada Communicable Disease Report. 2009;35S2.

Document History

Revision Date	Document Section	Description of Revisions
April 2022	Entire Document	New template. Appendix A and B merged. No material content changes.
April 2022	Epidemiology: Occurrence section	Removed.
April 2022	ICD Codes	Removed.