Eastern Equine Encephalitis (EEE)

Case Definitions

Nova Scotia's Surveillance Guidelines, including case definitions, are found here.

Causative Agent

Eastern equine encephalitis (EEE) is a zoonotic vector-borne disease caused by an arbovirus (*Togaviridae alphavirus* family) transmitted by a mosquito bite.

Source

The eastern equine encephalitis virus (EEEV) is maintained within a cycle between mosquitoes and birds, with passerine birds being the primary reservoir. The mosquito species, *Culiseta melanura,* which primarily bites birds, is responsible for spreading EEEV between birds. *C. melanura* abundance is closely associated with deciduous and evergreen forested wetlands, which are common in rural areas of Nova Scotia. When the *C. melanura* populations increase, the risk of EEEV amplification increases, as well.

Once a bird is infected from the bite of an infected mosquito, other mosquito species that commonly bite humans (*Aedes, Coquillettidia,* and *Culex*), feed on those birds, and then may transmit the virus to humans, or other mammals, such as horses. While mammals, including humans, may become infected with the virus, they do not develop virus levels of sufficient quantity in their bloodstream to pass the virus on to other biting mosquitoes. Humans and other mammals are considered dead-end hosts. Human cases are usually preceded by cases in horses.

Although there have not been any human EEE cases identified in Nova Scotia, cases have occurred in Eastern Canada.

EEE has been a notifiable disease in horses in Canada since 2003. The first case of EEE in horses was identified in NS in 2009; since then, there have been 10 cases with the most recent case being identified in 2024. For more information about recent EEE cases in horses in Canada, visit the CAHSS Equine Disease Dashboard.

Incubation

The incubation period for EEE typically ranges from 3 – 10 days after a mosquito bite.

Transmission

Transmission to humans occurs via the bite of an infected mosquito. The highest risk for transmission in Canada is typically July to October.

Communicability

EEEV has been documented to be transmitted through organ transplantation, from one organ donor transmitting the infection to three organ transplant recipients. Although not documented, EEEV theoretically could be transmitted person-to-person through blood transfusions.

Clinical Presentation

Most individuals infected with the virus do not show symptoms of illness. Some individuals experience fever, chills, malaise, arthralgia (joint pain), and myalgia (muscle pain) without central nervous system involvement. These symptoms generally last 1- 2 weeks, and most individuals make a full recovery.

The most severe form of illness is neuroinvasive disease, causing meningitis or encephalitis. Neuroinvasive infections are characterized by fever, headache, nausea, and vomiting, confusion, neck stiffness, weakness, and can progress to more severe symptoms, such as seizures and coma. People over age 50, and younger than 15, are at greatest risk of developing neuroinvasive disease. Those who recover from brain infection may suffer permanent neurological damage. The case fatality rate of neuroinvasive disease is estimated to be approximately 30%.

Diagnostic Testing

The primary method of EEEV diagnosis is serology. A $\geq$ 4-fold change in antibody titres between acute and convalescent specimens (taken at least 2 weeks apart) is suggestive of recent infection. CSF analysis usually shows an initial neutrophilic pleocytosis and elevated protein. Detection through nucleic acid amplification testing (PCR) of blood or cerebrospinal fluid may be helpful, particularly in immunocompromised individuals. It is important to note that negative PCR testing does not rule out the diagnosis of EEE. There are also often changes in the brain detectable by MRI. More details can be found in the Nova Scotia Surveillance Guidelines

The National Microbiology Laboratory supports provincial/territorial laboratories by performing human testing for EEE when requested. For additional information on diagnostic testing information, see the Nova Scotia PPHLN Microbiology Users Manual

Testing of asymptomatic individuals is not recommended.

Treatment

Treatment is outside the scope of public health. There is no specific treatment for EEE; however, Infectious Disease physicians should be consulted.

Case Management

The primary purpose of case management is to support ongoing surveillance and better understand the emergence and epidemiology of EEEV in Nova Scotia.

- Contact the case or proxy (e.g., parent/guardian, or close relative) to determine symptom onset, medical history, as well as recreational, occupational, and travel-related risk factors.
- Contact the health care provider to determine symptoms and clinical outcomes.

Long-term follow-up of cases by Public Health is not required. For details on information collected during case interview, please refer to the Nova Scotia Surveillance Guidelines

Education

There is no vaccine to prevent EEE disease in humans. The best method for preventing EEE in humans is to prevent mosquito bites. There are several simple actions that can be taken to reduce the likelihood of mosquito bites.

Reduce or eliminate potential mosquito breeding areas around the property, using techniques described in the Mosquito Control section below.

Wear light colored clothing. Dark colored clothing tends to attract mosquitoes. Wearing loose-fitting, full-length pants and long sleeves when exposed to mosquitoes minimizes the area of bare skin and creates a barrier against mosquito bites.

Mosquitoes are most active at dawn and dusk. Apply mosquito repellents to exposed skin according to label instructions when outdoors during times of peak mosquito activity. Permethrin-treated clothing also repels mosquitoes. Mosquito netting is an effective alternative to using mosquito repellents for camping, strollers, and baby carriers.

For more information on repellents, visit Health Canada's Personal Insect Repellents webpage.

Mosquito Control

In order to effectively control mosquitoes, an integrated mosquito management plan is essential to reduce mosquito habitat (food, water, and shelter). Mosquitoes can lay eggs and begin to multiply in any stagnant water that remains undisturbed for more than 4 days. Mosquito breeding sites can be found anywhere. The following techniques for mosquito management work best when implemented in a coordinated approach:

- Drain standing water to disrupt mosquito habitat and prevent mosquito breeding. At least once a week, turnover or empty items that hold water, such as bird baths, flowerpot saucers, buckets, containers, tires, toys, wading pools, or wheelbarrows. Drill holes in the bottom of containers that are stored outside (recycling and garbage containers) and install a mosquito screen to rainwater storage containers.
- Ensure proper maintenance of rain gutters to prevent blockages that may hold water.
- Use landscaping techniques to reduce or eliminate areas on your property that collect standing water.
- Biological controls can be used such as certain bacteria or predators to minimize mosquito presence in an area (e.g. fish that eat mosquito larvae in ornamental ponds).
- Use properly fitting screens and/or mosquito netting over openings to prevent mosquitoes from entering your home.

The application of insecticides for the control of mosquito larvae and adult mosquitoes is an alternative control method. For more information on the use of pesticides please visit the Pest Management Regulatory Agency or Nova Scotia Environment and Climate Change.

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