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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

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West Nile Virus Fact Sheet for Physicians

In recent years, health practitioners, along with the public, have become increasingly aware of the threat posed by emerging infections. During the summer of 1999, the West Nile Virus (WNV), a mosquito-borne virus from the Old World, emerged in New York City.

Background

The West Nile Virus is a member of the Japanese encephalitis virus complex that includes the St. Louis Encephalitis (SLE) virus, the Kunjin virus, and the Murray Valley encephalitis virus. All belong to the Flaviviridae virus family, genus *Flavivirus,* and are single-stranded RNA viruses. Cross-reaction between the WNV and SLE virus in the laboratory led to an initial misidentification of the New York City outbreak. The SLE virus has been known to cause periodic outbreaks of encephalitis in the United States. During the mid 1970s, more than 2,000 cases were seen in the Ohio-Mississippi River valleys, with 416 cases seen in Ohio. However, unlike the SLE virus that is endemic to the Americas, WNV had only been found in Africa, continental Europe, and western Asia. The 1999 outbreak in New York City that led to the identification of the WNV in mosquitoes, birds, and various mammals, including humans, was the first documentation of its presence in the Western Hemisphere.

Both WNV and SLE are arboviruses. Although *Culex* mosquitoes are the primary vectors of both viruses, worldwide, WNV has been isolated from 43 species of mosquitoes. Birds are the primary reservoir and amplification hosts for both viruses. A unique feature of the North American outbreak of WNV is the high mortality rate observed in numerous bird and mammal species. (In the year 2001, more than 6,000 infected dead birds, primarily crows, were reported, while more than 500 horses were found to have serious neurological disease.)

The earliest documented epidemic involving WNV occurred in Israel and involved more than 500 hospitalized patients. The largest epidemic on record occurred in the southern Cape provinces of South Africa during 1974 and resulted in thousands of human infections. Recent outbreaks of the WNV have occurred in Romania (1996-97), the Czech Republic (1997), Italy (1998), and Russia (1999). How WNV managed to be introduced into the United States is not known, nor is it known how long it has been here. There is speculation that the virus reached North America through imported birds or possibly by a mosquito that had been transported to the United States by ship or airplane. In February 2000, WNV was recovered from *Culex* mosquitoes that were over-wintering in New York City, suggesting that this strain of WNV is capable of surviving the winter (at least in the New York City area).

WNV West Nile Virus WORKGROUP

Ohio Department of Health • Ohio Department of Agriculture • Ohio Department of Natural Resources
The Ohio State University • Ohio Environmental Protection Agency • Association of Ohio Health Commissioners
Ohio Mosquito Control Association • Ohio Environmental Health Association • United States Department of Agriculture

Epidemiology

During the summer and autumn months of 1999 in New York City, seven of 62 people infected with the virus died. The outbreak was clinically apparent (but not definitively diagnosed) in the avian population prior to its detection in the human population. Disease in the equine population appeared concomitantly with human disease. Since then, the WNV has spread rapidly into 27 states and the District of Columbia.

In 2001, there were 56 human cases of WNV encephalitis reported in the United States, with seven deaths. In Ohio, WNV was first identified in a blue jay collected on July 11, 2001, in Lake County. It was subsequently identified in more than 250 birds and 26 mosquito pools from 29 counties. There were no human or horse cases. It is expected that WNV will continue to be a potential disease threat in Ohio in 2002.

The first human case of WNV encephalitis in the United States was diagnosed in early August 1999 in the New York City borough of Queens. Most cases became ill in the third and fourth weeks of August. All cases lived in Queens, the Bronx, Brooklyn, or Manhattan (one case was a Canadian tourist who had been visiting in Queens and subsequently became sick after returning home).

The incubation period for WNV encephalitis is usually six days, with a range of five to 15 days. Cases had a median age of 68 years (range 5 to 90), with only three cases occurring among children 16 or younger. The case fatality rate among the 59 hospitalized patients was 12%, with the seven deaths occurring among persons aged 68 to 87 years.

A study conducted in the epicenter of the outbreak (northern Queens) determined that seroprevalence for exposure to WNV was 2.6% of the surveyed population (46,220 persons). Approximately 20% of those who had antibodies to WNV also recalled suffering a febrile illness during the late summer or early fall. Those symptoms included fever (100%), myalgia (100%), headache (89%), fatigue (87%), and arthralgia (76%). This self-limiting illness generally lasted three to five days.

More recent surveys performed in three separate areas of New York City in 2000 demonstrated that the estimated incidence of recent WNV infection was less than the 2.6% seen in 1999. It is believed that this difference may be a result of prevention methods like mosquito larviciding, wide dissemination of public health messages, reducing mosquito breeding grounds, spraying to control adult mosquitoes, or it may reflect the sporadic nature of WNV outbreaks.

There is no evidence that the WNV can be transmitted from person to person. Humans, as well as horses, are dead-end hosts in the WNV life-cycle. In the 1999 New York City experience, the only significant risk factor shared by all the cases was that they had spent time out-of-doors, in the evening hours of late summer and early autumn.

Signs and Symptoms of Human Disease

In New York City during 1999, the most common signs and symptoms to occur among those persons hospitalized with WNV infections were fever (90%), muscle weakness (54%), headache (46%), altered mental status (44%), rash (22%), stiff neck (19%), arthralgia (17%), photophobia (15%), and myalgia (14%). The most common clinical presentations were encephalitis with muscle weakness (39% with median age of 75 years), encephalitis without muscle weakness (22% with median age of 71 years), aseptic meningitis (32% with median age of 60 years), and a milder illness characterized by fever and headache only (7% with median age of 64.5 years).

During the peak of the outbreak, 10% of viral meningitis cases reported to the New York City Health Department tested positive for WNV, as compared to 40% of all encephalitis cases and 60% of all encephalitis cases with diffuse muscle weakness. Of the 59 hospitalized patients, one was HIV positive (but did not have AIDS), and three were receiving immunosuppressive therapy for the treatment of cancer.

The outbreak of WNV in New York City was characterized by the unusual presentation of a diffuse-muscle weakness in many of the persons infected (a unique finding of the New York experience which has not been seen with WNV outbreaks in other countries).

Electromyographic studies of these patients demonstrated flaccid paralysis with axonal neuropathy. Consequently, some patients were initially diagnosed with **Guillain-Barré Syndrome**. Autopsy results demonstrated involvement of the brainstem and some cranial nerve roots. There were minimal pathological findings in the cortex or cerebellum. Differential diagnoses should include:

- **Enteroviral encephalitis or aseptic meningitis** (commonly occurs in late summer and generally is seen in younger patients).
- **SLE and LaCrosse encephalitis** (LaCrosse encephalitis is endemic in Ohio and is found primarily in wooded areas. It is seen most commonly in children less than 16 years of age. In the last seven years, Ohio has averaged 19 cases of LaCrosse encephalitis per year.).
- **Herpes simplex viral encephalitis** (particularly if the patient is demonstrating temporal lobe symptoms).
- **Varicella encephalitis** (particularly if a rash is present).

Reporting

All cases of viral encephalitis, viral Meningoencephalitis, and viral (aseptic) meningitis (confirmed or suspected) are Class A2 reportable diseases in Ohio. Under this designation, the physician must notify his or her local health department of the existence of a case, a suspected case, or a positive laboratory result by the end of the next business day.

Laboratory Testing

Optimal testing for diagnosis involves submitting serum specimens obtained during the acute period of infection (within the first week of onset of symptoms) along with cerebrospinal fluid also obtained during this period. A subsequent convalescent serum specimen (obtained two to four weeks, or more, after the acute specimen) should also be obtained. If cerebrospinal fluid is obtained during the convalescent period, it should also be forwarded for diagnosis.

As was discovered in the outbreak in New York City, antibodies to WNV may cross-react with SLE testing. Therefore, positive serologic testing for SLE virus may represent WNV infection and requires further investigation.

Any hospitalized patient with a clinical diagnosis of viral encephalitis, viral Meningoencephalitis, or aseptic meningitis with an onset date between June and November may be suspect of having WNV. Blood and/or cerebrospinal fluid (acute and convalescent) can be sent to the Ohio Department of Health Laboratory (ODHL) for arboviral serologic panel testing. The ODHL panel will detect antibodies to West Nile, LaCrosse, and St. Louis encephalitis viruses by using an IgM and IgG capture enzyme linked immunosorbent assay (ELISA).

Should brain tissue also be available, it should be sent to the ODHL. Brain tissue submitted from biopsy or fatal cases will be forwarded to the Centers for Disease Control and Prevention (CDC) for polymerase chain reaction (PCR) testing. All specimens found to be positive for WNV or SLE virus by ELISA serologic testing will be forwarded to the CDC for confirmation.

When sending specimens to ODHL, please send them to the following address:

Ohio Department of Health Laboratory
1571 Perry Street
P.O. Box 2568
Columbus, Ohio 43216
1-888-ODH-LABS

Treatment and Prevention

There is no specific treatment for WNV encephalitis. All care is supportive. No vaccine or antiviral medication has been developed to prevent or treat this infection. Primary prevention includes protection against mosquito bites, reducing residential mosquito breeding sites, and mosquito control efforts.

It is recommended that people who go outdoors, particularly in the evening and nighttime hours of the summer and the autumn months, should wear long-sleeved shirts, long pants, and apply insect repellents to clothing and skin. When applying an insect repellent, consider using one that contains 15% or less DEET (N, N-diethyl-methyl-meta-toluamide) for children and no more than 30% DEET for adults. DEET is effective for approximately four hours.

Prolonged or excessive use of DEET should be avoided. Discretion should be exercised when recommending DEET for persons who have acne, psoriasis, or other chronic skin conditions. DEET may cause a contact dermatitis. It may also cause a toxic encephalopathy, particularly in children, if they have been repeatedly exposed or exposed to high concentrations of the repellent. As a result, DEET should not be used on infants or pregnant women. When using any insect repellent, it is important to follow the directions on the container.

Like most mosquitoes, *Culex* mosquitoes breed in standing water. They have a particular predilection for standing water with a high organic content. Mosquitoes are known to breed in any collection of standing water that lasts for more than four days. Therefore, people may lessen their risk of being bitten by an infected mosquito if they ensure that abandoned tires, tin cans, plastic containers, wading pools, ceramic pots, bird baths, or similar water-holding containers on their property are not holding stagnant water. Roof gutters clogged with leaves also provide an ideal environment for mosquito breeding. Keeping the door and window screens in good repair will help prevent mosquitoes from entering the house.

Mosquito control programs involve the use of pesticides. Larviciding is the first line of control and frequently involves the use of biological agents like *Bacillus sphaericus* or *Bacillus thuringiensis*. Spraying to kill adult mosquitoes involves the use of pyrethroids or organophosphates.

Pyrethroids are derivatives of the chrysanthemum plant and are only toxic to humans if exposure concentrations are extremely high. Toxic effects may include headache, vomiting, diarrhea, ataxia, muscle fasiculations, paresthesias, seizures, and pulmonary edema. Organophosphates, like the pyrethroids, can be absorbed through inhalation, ingestion, or skin penetration. Symptoms of organophosphate toxicity may include headache, nausea, diarrhea, abdominal cramps, dizziness, miosis, sweating, salivation, lacrimation, and rhinorrhea, all evidence of cholinergic stimulation.

The symptoms may worsen if there has been exposure to higher concentrations of the insecticide. These symptoms can include weakness, muscle fasiculations, ataxia, bradycardia, bronchospasm, seizures, altered level or loss of consciousness, and finally death.

See the National Pesticide Telecommunications Network web site at **http://nptn.orst.edu/wnv/** for more details about specific insecticides.

Ohio's Plan

During the fall of 2000, the Ohio Department of Health, in conjunction with the Ohio Departments of Agriculture and Natural Resources, the Ohio Environmental Protection Agency, the Ohio State University, the U.S. Department of Agriculture, local health departments, and other interested parties, initiated a working group to address this potential public health threat in

Ohio. A plan for Ohio was written and is available at the ODH Zoonoses Website at **http://www.odh.state.oh.us/ODHPrograms/ZOODIS/ZooMain1.htm**. Efforts focusing on prevention and control, surveillance, education, training, and infrastructure have been emphasized

What Is the Status of West Nile Virus In Ohio?

WNV has been confirmed in Ohio. For the current status on WNV in Ohio and for more information, contact your local health department or log on to the following web sites:

Ohio Department of Health
http://www.odh.state.oh.us/ODHPrograms/ZOODIS/ZooMain1.htm

Ohio State University
http://prevmed.vet.ohio-state.edu/

For additional information, contact your local health department. You may also contact the Ohio Department of Health's Vector-borne Disease Program at 900 Freeway Drive, Columbus, OH 43229 or call 614-752-1029 or e-mail us at **zoonoses@gw.odh.state.oh.us**

Visit Ohio State University Extension's WWW site "Ohioline" at:
http://ohioline.ag.ohio-state.edu

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