Overview

• Diseases and characteristics.
• Data and statistics.
• Diagnosis and treatment.
• Disease control and prevention.

Arbovirus Infections

• In Wisconsin, arboviruses include La Crosse (LAC)/California encephalitis (CA), Jamestown Canyon (JC), West Nile virus (WNV), and Powassan (POW) virus infections.
• Mosquito transmitted infections (LAC, CA, JC, EEE, and WNV).
• Powassan virus is the only tick transmitted arboviral infection.
• Infections usually occur during warmer months when mosquitoes and ticks are active.

Arboviral Surveillance in WI, 2002-2011

Total Cases (%)

<table>
<thead>
<tr>
<th>Mosquitoborne infections/year</th>
<th>2011**</th>
<th>2002-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Nile virus (WNV)</td>
<td>3 (13)</td>
<td>140 (53)</td>
</tr>
<tr>
<td>La Crosse (LACV)/California virus group</td>
<td>8 (35)</td>
<td>69 (26)</td>
</tr>
<tr>
<td>St. Louis, Eastern equine, and Western equine</td>
<td>1 (4.3)</td>
<td>0</td>
</tr>
<tr>
<td>Jamestown Canyon</td>
<td>2 (8.7)</td>
<td>0</td>
</tr>
<tr>
<td>Travel-related mosquitoborne infections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dengue*</td>
<td>5 (22)</td>
<td>45 (17)</td>
</tr>
<tr>
<td>Chikungunya*</td>
<td>0</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td>Tickborne infections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powassan</td>
<td>4 (17)</td>
<td>7 (2.7)</td>
</tr>
</tbody>
</table>

* Travel related infections
**2011 numbers include confirmed and probable cases

Arboviral Diseases Reported in WI, 2007-2012 (n=125)

<table>
<thead>
<tr>
<th>Year of illness onset</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVNV</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>LAC/CA</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>POW</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>EEE</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>JC</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Arbovirus Diagnosis and Treatment

• Arboviral infections are diagnosed by clinical presentation and laboratory tests (blood and CSF).
• There is no specific treatment for arboviral infections; supportive care and relief of symptoms is all that is available.
• In general, infection with an arbovirus can provide life-long immunity to that specific virus.
• No available vaccines.
West Nile Virus (WNV)

- Originally isolated from West Nile province of Uganda in 1937.
- Introduced to US (NYC) in 1999.
- Now endemic to most of the United States.
- In 2002, first WNV outbreak in WI with 52 cases (average 10 cases/year in the last 10 years).

Wisconsin WNV Surveillance

Statewide surveillance
- WNV surveillance includes 3 major components: monitoring for human illnesses, equine, dead corvid birds (crow, raven, and blue jay), and mosquito testing.
- Human surveillance is based on laboratory positive results, physician and providers reports using electronic reporting to the Wisconsin Electronic Disease Surveillance System (WEDSS) or a hard copy of the case report form.
- Non-human activities are coordinated among numerous partners: local health departments, DNR, USDA-Wild Life Services, Wisconsin State Laboratory of Hygiene, UW-Vet Diagnostic Laboratory.
- All arbovirus activities are reported to CDC.

Local Levels

Local Health Departments (LHDs)
- Submit dead birds to the Dead Bird Hotline for testing.
- Investigate cases, conduct public education, and perform mosquito control activities in their regions.
- In 2012, no federal funding was available for mosquito surveillance.
- Dane County was the only county to provide limited mosquito surveillance using their own funding.

WNV Infections

- WNV symptoms usually occur 3-14 days from a bite of an infected mosquito.
- About 20% of the people infected with WNV will have symptoms that can be mild and include headache, fever, fatigue, muscle aches and swollen lymph nodes; about 80% of the people may not have any symptoms.
- Severe neuroinvasive illness occurs in <1% of the people - paralysis, encephalitis (swelling of the brain) and meningitis, confusion, coma, and death.
- Children, the elderly, and people with compromised immune systems are at increased risk of severe disease.
- Other types of transmission- contaminated blood and blood products, organs and tissues, and breast milk.
Human Disease Surveillance, WI

WNV characteristics 2011 2012
Total 3 57
Neuroinvasive 2 44/77%
Fever 1 13/23%
Age range (median) 44-65(60) 7-83(53)
Hospitalizations 2 35/61%
Deaths 0 5/9%
Males/Females 3/0 30/28%
Positive viremic donor 0 14

Confirmed and Probable West Nile Virus Cases
Reported by Month - WI 2012 (n=57)

Confirmed and Probable West Nile Virus Cases
Reported by Age Group - WI 2012 (n=57)

Human Disease Surveillance, 2012, WI

Case-patients using repellents Total (%)
Most of the time 3 (5%)
Some of the time 12 (21%)
Never 16 (29%)
Don’t remember 6 (11%)
Unknown 19 (34%)

Bird Surveillance Components

Statewide Dead Bird Reporting Hotline 1-800-433-1610
- From May 1 - October 31: a total of 1,127 phone calls from citizens in 2012 compared to 308 calls in 2011 (almost a 4-fold increase).
- 30 (42%) out of 71 samples collected for testing were positive in 2012 compared to 17 (59 collected) positive birds in 2011.
- WNV activities in 25 counties.
- Also monitor for unusual large number of birds die-off (avian influenza).

Mosquito Surveillance

- Mosquito surveillance can be expensive and labor intensive.
- It can be helpful to know the different type of mosquito species circulating in Wisconsin but past experience showed that it is not a good system for early warning.
- Monitor for man-made or artificial habitat for mosquito species transmitting WNV and LAC viruses.
- Monitor for long term natural breeding areas- ditches, storm sewers, woodland, ponds, and wetland areas.
- Dane County and UW – Madison, Dept. of Entomology collected over 505 mosquito pools for testing in 2012 but no positive pools were identified.
**WNV Infections National Data**

As of December, 2012 –

- 5,387 human cases in 931 counties from 48 states reported human WNV cases in CDC ArboNet database.
- 2,734 (51%) reported neuroinvasive disease.
- 2,653 (49%) reported uncomplicated fever; many more cases are unrecognized and not reported.
- 243 (5%) deaths.
- 597 presumptive viremic blood donor; 16% developed clinical illness and are counted in the human disease cases.

**Tickborne Diseases in Wisconsin**

Powassan Virus and Novel *Ehrlichia* species

**Ixodes scapularis** (Blacklegged or Deer Tick)

- Adult female deer tick
- Adult male deer tick
- Nymph
- Larva

Smaller than a American dog/wood tick, adult female and nymph can transmit infection through a bite for a blood meal

**UW-Madison, Department of Entomology- Tick Surveys**

1981

1994

2008-2009

Dark color of the pie= % deer infested with *Ixodes* ticks.

**Wisconsin Tick Surveillance, 2011-2012**

Ticks collected from different agencies in Wisconsin.

**I. scapularis Found On All Animal Species, 2011-2012**

- *I. scapularis* found on animals from counties.
- No submissions from participating counties.
Powassan Virus Infection

- Rare tickborne arbovirus infection.
- Initially isolated in 1958, in Northern Ontario.
- Cases have been reported in northern regions of United States (Maine, Michigan, Minnesota, New York, Vermont, and Wisconsin).
- Reservoir- small mammals.
- Vector- Ixodes scapularis.

Powassan Virus Cases, WI, 2003 - 2012

Powassan- Clinical Diagnosis

- Incubation period is usually >/= 1 week (range from 8-34 days).
- Acute onset of fever, muscle weakness, confusion, headache, nausea, vomiting, and stiff neck.
- Severe signs and symptoms- respiratory distress, tremors, seizures, gait unbalance, confusion, paralysis, and coma.
- Neuroinvasive disease- most of the cases reported meningoencephalitis leading to long-term neurologic sequelae.
- 10%-15% cases are fatal.
- Supportive treatment only and no vaccine is available.

Powassan virus (POWV) Testing

- There is no commercial test available for Powassan virus.
- CDC will perform testing for Powassan upon state’s request if symptoms are consistent with an arbovirus-like illness.
- All commercial positive results for arbovirus agents need to be confirmed at Wisconsin State Laboratory of Hygiene (WSLH) and CDC.
- POWV IgM and IgG testing can be performed on serum or CSF using MAC-ELISA and plaque-reduction neutralization test (PRNT) at CDC.
- Physician should consider requesting POW testing if commercial tests resulted in non-specific reactivity to an arbovirus agent or a negative result and patient continues to exhibit signs and symptoms consistent with an arbovirus infection.

Anaplasmosis/Ehrlichiosis

- Prior to 2008, anaplasmosis and ehrlichiosis infections were referred to as human granulocytic ehrlichiosis (HGE) and human monocytic ehrlichiosis (HME), respectively.
- Since 2008, surveillance for human anaplasmosis and ehrlichiosis are classified as:
  - Anaplasmosis caused by the A. phagocytophilum bacteria (transmitted by the blacklegged tick).
  - Ehrlichiosis caused by E. chaffeensis, E. ewingii (transmitted by the Amblyomma americanum or lone star tick).
  - Anaplasmosis/Ehrlichiosis undetermined (species unknown) including the new species E. muris-like (EML).
- Increase in probable cases of E. chaffeensis (lone star tick vector not traditionally seen in Wisconsin.)
- In 2009, identified a cluster of novel E. muris-like cases.
Investigation of Novel *E. muris*-like (EML) Cluster, 2009

- Index case: June 12, 2009.
- Male, 51 years.
- Clinical presentation: fever, headache, myalgia.
- Laboratory findings: lymphopenia (low lymphocytes), thrombocytopenia (low platelets), and elevated liver enzymes.
- Testing performed by Mayo labs- multiplex PCR, differentiated different agents by melting point curves.
- CDC confirmation- PCR and sequencing confirmed novel *Ehrlichia* species similar to *E. muris*, referred to as *E. muris*-like.
- From 2009-2012, Wisconsin identified 22 confirmed EML cases.

Investigation of *E. muris*-like Cluster (cont.)

- Obtained all acute and convalescent samples of all reported *Ehrlichia* cases for testing at CDC.
- Obtained and reviewed medical records.
- Standardized investigation questionnaire to interview patients regarding potential exposures.

- All EML patients had exposure to ticks at home and/or in another county in WI.
- Many reported seeing deer and wild animals in their backyard.

Novel *Ehrlichia* Species, *E. muris*-like (EML)

- In 2009, EML was first identified in a cluster of four case-patients from Wisconsin (3) and Minnesota (1). This atypical *Ehrlichia* had never before been identified in North America.
- From 2009-2012, a total of 33 confirmed EML cases have been identified from both states and one case-patient was cultured positive.
- No EML positive results were found in 7,827 patients residing in other states tested by Mayo Labs using the multiplex PCR.
- Species is closest to *E. muris* associated with the white-footed mouse (*Peromyscus leucopus*) in Japan.
- The test of choice is PCR, no commercial serology tests are yet available.
- 38 *I. scapularis* ticks and two white-footed mice were PCR positive for EML, no other tick vectors have been identified.

Avoid Mosquito Bite to Prevent Infection

- Limit time spent outdoors at dawn and dusk.
- Avoid shady areas where mosquito may be resting.
- Wear protective clothing.
- Apply insect repellent (DEET, Picaridin, IR3535, oil of lemon eucalyptus), follow product instructions.
- Permethrin can be used on clothing and can be purchase at sporting good stores, follow label instructions.
- For CDC repellents information, visit this website: [http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm](http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm)
**Effective Mosquito Control Methods**

- Prevent mosquitoes from getting inside of your homes by making sure window screens don’t have any holes.
- Remove breeding sites such as containers filled with water, toys, pots, wading pools, or discarded tires.
- Change the water in birdbaths and pet dishes at least every three days.
- Clean roof gutters and downspouts for proper drainage.
- Landscape to prevent water from pooling, trim tall grasses, weeds and vines.

**Mosquito Products**

**Repellents that work:** CDC recommends EPA registered products.
- DEET
- Picaridin
- Oil of lemon eucalyptus
- IR3535

**Products that do not work:**
- Carbon dioxide baited mosquito traps
- Citrosa plants
- Eating garlic or taking vitamin B
- Scented personal products
- Alcohol

**Don’t Get Bitten by a Tick**

- Check for ticks after being outdoors.
- Take showers to wash off crawling ticks.
- When in wooded areas, walk on cleared pathways and trails to reduce the chance of coming in contact with ticks.
- Wear protective clothing, long pants and sleeves.
- Tuck shirts into pants and pants into socks or boots to prevent ticks from crawling under clothing and attaching to skin.
- Use repellents per label instructions (20-30% DEET).
- Permethrin spray for clothing.

**Environmental Tick Control**

- Integrated pest management.
- Landscape to create tick safe areas.
- Remove leaf litters.
- Trim bushes and shrubs.
- Spray acaricides - EPA registered companies.
- Apply natural products with biocidal activities (nookatone - yellow cedar, grapefruit and orange peel) or botanical products (oil of rosemary).

**References**

- Division of Public Health Arbovirus website: [http://www.dhs.wisconsin.gov/communicable/ArboviralDiseases/index.htm](http://www.dhs.wisconsin.gov/communicable/ArboviralDiseases/index.htm)

**Additional Questions**

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