Arboviral Diseases
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Jodi Reber, RN

SLIDE 1 TITLE

SLIDE 2
Hi. My name is Jodi Reber. I am the vectorborne nurse epidemiologist and a regional communicable disease nurse consultant. My presentation today is on reportable arboviral diseases in North Carolina.

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First off, when you hear the word arboviral…..think mosquito. Now, why do we care about mosquitoes? In general, arboviral diseases cannot be spread from human to human….right? Not exactly…… there are 3 mosquito-borne illnesses, Malaria, Dengue and Yellow Fever, where the sick human may be able to pass the disease to another mosquito …thus allowing the cycle of disease transmission to continue. Although these three diseases are not currently endemic in the United States, that was not always the case. In 1914, there was an estimated 600,000 cases of Malaria in the United States. Surveillance efforts have contributed to the successful eradication of Malaria in the U.S.

When we monitor for arboviral disease, we must consider what mosquito species are present in a particular region as well as the normal feeding patterns associated with the species in that region. Different feeding patterns can lead to different diseases being present. Each animal that the mosquito feeds upon, birds, squirrels, chipmunks, etc. can carry different diseases that now are carried within the mosquito and potentially passed to a human. There are also diseases that are directly passed from the mother mosquito to the eggs, thus the mosquito is born with the disease.

So, we still continue with our arboviral surveillance in order to make the public aware of what mosquito borne diseases are still present within our communities; advise on prevention measures; and monitor for reintroduction of old diseases and potential emergence of new ones .

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The learning objectives for this presentation are to identify the reportable arboviral diseases in North Carolina; to understand the difference between neuro-invasive and non neuro-invasive arboviral disease; to distinguish between viral and bacterial causes of meningitis/encephalitis; and lastly, to identify key surveillance criteria for arboviral illness that will help you during your case investigations.

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Arboviral illness is a leading killer throughout the world. I spoke a little bit about Malaria earlier, but did you know that in 2010, an estimated 660,000 people died of malaria --and these were mostly young children in sub-Saharan Africa? As I said before, lucky for us, we live in the US, where malaria has been eradicated. However, although we do not have the arboviral morbidity and mortality rates that other countries do North Carolina is not free from disease and death caused by the transmission of infection from the mosquitoes around us.

As we all well know, mosquitoes bite every chance they get. But what you may not know is that many of us are often infected by microorganisms they inject into us; we just don't get that sick. Most of us may be asymptomatic or just suffer a mild flu-like illness. However, some individuals may have fever, headache, myalgias, malaise and occasionally collapse from complete exhaustion. And others, unfortunately, when the virus has invaded the central nervous system, may suffer with problems such as encephalitis, which is inflammation of the brain, and aseptic meningitis, which is inflammation of the lining of the brain, which can lead to seizures, coma, and even death.

And also remember one fact that I briefly mentioned earlier in this presentation. Although we cannot give a mosquito-borne illness to another human, we can, if infected with Malaria, Dengue or Yellow Fever, give it to another mosquito. In fact, between 1957 and 2009, in the United States, 63 outbreaks of locally transmitted mosquito-borne malaria have occurred. In such outbreaks, local mosquitoes become infected by biting persons carrying the malaria parasite and then transmit malaria to local residents. On average, about 1,500 cases of Malaria are diagnosed in the United States each year. The vast majority of cases in the United States are in travelers and immigrants returning from countries where malaria transmission occurs, many from sub-Saharan Africa and South Asia. So, as stated earlier, in order to help keep the public safe from these potentially deadly infections, we do keep surveillance information on them.

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For those arboviral illness that can be acquired here in North Carolina, we conduct surveillance on those that are considered neuro-invasive, meaning the virus has gotten into the central nervous system and is causing severe disease. We do not collect surveillance data on milder illnesses that have occurred outside of the central nervous system, which is referred to as non neuro-invasive disease. We will speak more about this in a minute.

LaCrosse (LAC) Encephalitis is the most common arboviral illness acquired in North Carolina. The vast majority of NC residents who acquire LAC infections live in the western part of NC. The most serious neuro-invasive cases tend to affect children less than 16 years of age. With that, I want to tell you a story. This story is based on true events and occurred in the summer of 2009. A brother and sister were having fun on their summer break. Within a day of each other, they both started feeling bad with fever, headache, muscle aches and fatigue. The boy soon started vomiting, showing signs of altered mental status, and having seizures. He was taken to the hospital with uncontrollable seizures. By the next day, his sister was also admitted to the

hospital with similar symptoms. The physicians tested for multiple issues, and even included testing for mosquito-borne illness. The initial testing for mosquito-borne illness did not show a clear positive for mosquito-borne illness. Although the physicians were doing everything they could do, within 5 days, the boy died. Luckily, his sister survived. Upon further investigation and follow-up testing with the sister, it was determined by the Centers for Disease Control that in fact, they both had LaCrosse encephalitis.

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In addition to LaCrosse Encephalitis, North Carolina law requires reporting of all Arboviral encephalitis. The other arboviral diseases are: West Nile Virus, Eastern Equine Encephalitis, Western Equine Encephalitis, and St. Louis Encephalitis. Different arboviral diseases typically affect different parts of North Carolina. In general, the signs and symptoms of neuro-invasive arboviral disease are the same. We determine the exact causative agent by performing laboratory tests.

As stated earlier, we also provide surveillance for diseases not considered endemic in the United States. We want to ensure that any citizen of North Carolina who might come down with these diseases (Malaria, Dengue and Yellow Fever) did not acquire it here. We are also interested in ensuring we know the exact organism causing these illnesses as well as any antibiotics used to treat the illness. There is always monitoring for drug-resistant organisms.

You may be asked at times to help facilitate getting lab samples to the North Carolina State Laboratory for Public Health and the Centers for Disease Control for evaluation.

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Let me clarify a few things. Encephalitis and meningitis can be caused by many different microorganisms and toxic substances. Arboviral neuro-invasive disease is specifically caused by different viruses. Bacterial causes for CNS diseases are not arboviral. Also, to distinguish between a bacterial cause of meningitis and a viral cause of meningitis, different terms may be used. If a bacterium is the causative agent of the disease, it will be referred to as meningitis or bacterial meningitis. If the causative agent is viral, it will be referred to as aseptic meningitis or viral meningitis. Keep this in mind when you are looking at physician's notes. When we think of aseptic meningitis (inflammation of the lining of the brain) and encephalitis, consider the swelling that is occurring and the pressure being put on different parts of the brain and even the blood flow to the brain. The swelling could be mild and so the person only has fever and headache, or it could become more severe and include symptoms such as stiff neck, confusion, personality changes, paralysis, seizures, coma, and death. And unfortunately, some of the people who recover from a more severe form of arboviral illness will suffer long- term problems, such as problems with mobility, speech, and memory.

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When you investigate these types of cases, please keep these things in mind. Understanding the case definitions for arboviral disease, just like tickborne disease, might seem quite confusing. Do not hesitate to contact your CD regional nurse consultant for help. And remember these few tips: for neuro-invasive disease, both clinical criteria and laboratory criteria must be met. It is not good enough to have positive labs …. we must know the patient's clinical symptoms and the physician's diagnosis.

Always remember to assess a patient's travel history. We try to monitor where the disease-causing mosquitoes are located. For example, if people on the east coast of North Carolina started coming down with LaCrosse encephalitis, and there was no history of travel outside their home counties, that would alert us to the possibility that the mosquito has now traveled to the eastern part of the state or a new feeding cycle is occurring. And if people started coming down with Malaria or Dengue fever and did not have a history of any travel to any area endemic for these diseases, we could have another local outbreak on our hands.

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When you look at the laboratory criteria discussed in the Arboviral case definition, it can seem a bit intimidating. Don't worry. Remember you have consultants who can help. So for now, let me just discuss a few basics to get you started.

Look at the 1st bullet point…….Any time you can isolate an organism (in this case a virus) by either growing it in a culture – or – by seeing it under a microscope - or- by recognizing a part of the organism's DNA – or by recognizing the organisms identifying antigen signature…that's pretty significant. It's direct evidence that the offending organism is present.

Case definitions may describe specific tests related to, let's say, microscopy, for example……telling what specific way to stain the slide. It could say do it by DFA (Direct Florescent Assay)….or….IFA (Indirect Florescent Assay)….or IHC (immunohistochemical method)…..but the bottom line is that they will try to identify the organism under the microscope.

It just so happens that these types of specifics are not defined in this case definition…so the specific testing manner of identifying the virus is not so important in arboviral disease.

Now look at the other four bullet points. They all have something in common. They are talking about a more indirect method of knowing the virus is present. And that concept relates to the presence of antibodies. Meaning, if your body is producing antibodies that are identified with a particular organism….then the organism must be present!

For all of the communicable disease there are two specific antibody categories that fight off illness. These antibody categories are IgM and IgG. IgM will be the first to respond and the IgG will come on later in the course of illness. So for arboviral illness, there is great significance in seeing a positive IgM antibody test.

There are several types of tests that can be performed on antibodies. The main three available in most labs are EIA testing, IFA testing and Western Blot testing. These different type of test relate directly to some of the wording used in the lab case definitions. For example, the second bullet point says "4-fold or greater change in virus specific quantitative antibody titer in paired sera." This is specific to an IFA type of test…where the answer comes in the form of a titer (or ratio)….and then you take the test at 2 different points of time in the illness….and then compare the results.

There are still other tests that may only be performed, right now, at the CDC….such as virus specific neutralizing antibodies (mentioned in bullet point 3). So, as I mentioned earlier in this presentation, you could be asked to help get specimens to send off to the CDC.

Now don't worry…you are not expected to know all of this right now. It will take time and continued education. Just remember to work with your CD Regional Nurse Consultant…we are here to help.

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A quick word about prevention. There are many things that can be done to prevent tick and mosquito-borne disease. You'll learn about these things as you complete the activities for this unit. Thank you and have a great day.

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References