California Association for Medical Laboratory Technology

Distance Learning Program

ZIKA VIRUS
Course # DL-014

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Approved for 1.0 CE
CAMLT is approved by the California Department of Public Health as a CA CLS Accrediting Agency (#21)

Level of Difficulty: Basic

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This is a reminder that all the continuing education units required to renew your license/certificate must be earned no later than the expiration date printed on your license/certificate. If some of your units are made up of Distance Learning courses, please allow yourself enough time to retake the test in the event you do not pass on the first attempt. CAMLT urges you to earn your CE units early!
DISTANCE LEARNING ANSWER SHEET
Please circle the one best answer for each question.

COURSE NAME  ZIKA VIRUS  

NAME_________________________  LIC. #  _______________  DATE_________

SIGNATURE (REQUIRED) _______________________________________________________________________

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1.0 CE – FEE: $12.00 (MEMBER) | $22.00 (NON-MEMBER)

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EXP. DATE ________  |  SECURITY CODE: ___  -  ___  - ___

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DISTANCE LEARNING EVALUATION FORM

According to state regulations, this form must be completed and returned in order to receive CE hours. Your comments help us to provide you with better continuing education materials in the distance learning format. Please circle the number that agrees with your assessment with, with 5 meaning you strongly agree and 1 meaning you strongly disagree.

1. Overall, I was satisfied with the quality of this Distance Learning course.
   
   5 4 3 2 1

2. The objectives of this Distance Learning course were met.
   
   5 4 3 2 1

3. The difficulty of this Distance Learning course was consistent with the number of CE hours.
   
   5 4 3 2 1

4. I will use what I learned from this Distance Learning course.
   
   5 4 3 2 1

5. The time to complete this Distance Learning course was: _________ hours

6. Please comment on this Distance Learning course on the back of this sheet. What did you like or dislike?
INTRODUCTION: The spread of Zika virus illness is of particular concern because of the complication of microcephaly in fetuses of infected mothers. In May 2015, the Pan American Health Organization issued an alert regarding the first confirmed Zika virus infection in Brazil. The outbreak in Brazil led to reports of pregnant women giving birth to babies with birth defects and poor pregnancy outcomes, and of occasional Guillain-Barré syndrome in adults. Currently outbreaks are occurring in many countries, particularly in northern South America, islands in the Caribbean, Central America, and Mexico. Zika virus will continue to spread and it will be difficult to determine how it will spread over time.

OBJECTIVES
At the conclusion of this course the participant will be able to:
1. Outline the history of Zika virus and illness
2. Explain the virology and pathogenesis of Zika virus
3. State the dynamics of transmission
4. Discuss the clinical manifestations/diagnosis
5. Summarize the laboratory diagnosis of Zika virus disease
6. Discuss the treatment of Zika virus disease
7. Outline the methods of prevention
8. State the geographic distribution
9. List the complications in infants/adults

DISCUSSION
The Zika virus (ZIKV) is related to yellow fever, dengue, West Nile, and Japanese encephalitis viruses. Zika virus was first detected in Africa and remained there for years. In 2007, ZIKV caused an outbreak of relatively mild disease characterized by rash, arthralgia, and conjunctivitis on Yap Island in the southwestern Pacific Ocean. This was the first time that ZIKV was detected outside of Africa and Asia. Presently there are outbreaks in South and Central America and the illness has been associated with microcephaly in fetuses of infected mothers. The history, transmission dynamics, virology, clinical manifestations, and diagnosis of ZIKV disease are discussed, along with the import of the disease and possible spread of the Zika virus into North America. Methods of prevention are also presented.

HISTORY
On April 18, 1947, fever developed in a rhesus monkey that had been placed in a cage on a tree platform in the Zika Forest of Uganda (3). The monkey, Rhesus 766, was a sentinel animal in the Rockefeller Foundation’s program for research on jungle yellow fever. Two days later,
Rhesus 766, still febrile, was brought to the Foundation’s laboratory at Entebbe and its serum was inoculated into mice. After 10 days, all mice that were inoculated intracerebrally were sick, and a filterable transmissible agent, later named Zika virus, was isolated from the mouse brains. In early 1948, ZIKV was also isolated from Aedes africanus mosquitoes trapped in the same forest. Serologic studies on people indicated that humans could also be infected. Transmission of ZIKV by artificially fed Aedes aegypti mosquitoes to mice and a monkey in a laboratory was reported in 1956.

ZIKV was isolated from humans in Nigeria during studies conducted in 1968 and during 1971–1975. In one study there, 40% of the persons tested had neutralizing antibody to ZIKV. From 1951 through 1981, serologic evidence of human ZIKV infection was reported from other African countries such as Uganda, Tanzania, Egypt, Central African Republic, Sierra Leone, and Gabon, and in parts of Asia including India, Malaysia, the Philippines, Thailand, Vietnam, and Indonesia. In additional investigations, the virus was isolated from Aedes aegypti mosquitoes in Malaysia, a human in Senegal, and mosquitoes in Côte d’Ivoire. In 1981, Olson et al. reported 7 people with serologic evidence of ZIKV illness in Indonesia. A subsequent serologic study indicated that 13% of human volunteers in Lombok, Indonesia, had neutralizing antibody to ZIKV.

In April 2007, an outbreak of illness characterized by rash, arthralgia, and conjunctivitis was reported on Yap Island in the Federated States of Micronesia. Serum samples from patients in the acute phase of illness contained RNA of Zika virus. These findings showed that ZIKV had spread outside its usual geographic range (1,2).

In May 2015, the Pan American Health Organization (PAHO) issued an alert regarding the first confirmed Zika virus infection in Brazil. The outbreak in Brazil led to reports of Guillain-Barré syndrome in adults and pregnant women giving birth to babies with birth defects and having poor pregnancy outcomes. Currently, outbreaks are occurring in many countries; in particular concern to the U.S., the countries of northern South America, Puerto Rico and other islands in the Caribbean, Central America, and Mexico.

VIROLOGY, TRANSMISSION, AND PATHOGENESIS

Zika virus (ZIKV) is a flavivirus related to yellow fever, dengue, West Nile, and Japanese encephalitis viruses. Zika virus is transmitted to people primarily through the bite of an infected Aedes species mosquito (A. aegypti and A. albopictus). These are the same mosquitoes that spread dengue and chikungunya viruses. Mosquitoes become infected when they feed on a person already infected with the virus. Infected mosquitoes can then spread the virus to other people through bites. These mosquitoes typically lay eggs in standing water in small containers such as buckets, bowls, animal dishes, flower pots, and vases. They prefer to bite people, and live indoors and outdoors near people. Mosquitoes that spread chikungunya, dengue, and Zika are aggressive daytime biters but can also bite at night.

As of late April, 2016, there have been reports in the U.S. of sexually transmitted Zika virus (8 proven and a number of others awaiting confirmation). Questions about how frequently Zika can be transmitted by sex and how long the virus can stay in semen are particularly urgent, given the large volume of travel between the United States and Central and South America. Prevention of sexual transmission of Zika virus to pregnant partners or to partners possibly becoming pregnant is of upmost importance. Men who reside in or have traveled to an area of ongoing Zika virus transmission, and who have a pregnant or possibly becoming pregnant
partner, should abstain from sexual activity, or consistently and correctly use condoms during sex with their partner for at least 8 weeks.

Other, rare, methods of transmission are to an infant from an infected mother and through infected blood. In late February of 2016 the American Red Cross asked potential blood donors who have traveled to areas where Zika infection is active to wait 28 days before giving blood.

About 1 in 5 people infected with Zika virus become ill (i.e., develop Zika). The most common symptoms of Zika are fever, rash, joint pain, and conjunctivitis (red eyes). Other common symptoms include muscle pain and headache. The incubation period (the time from exposure to symptoms) for Zika virus disease is not known, but is likely to be a few days to a week. The illness is usually mild with symptoms lasting for several days to a week. People usually don’t get sick enough to go to the hospital, and they very rarely die of Zika. Zika virus usually remains in the blood of an infected person for about a week but it can be found longer in some people.

DIAGNOSIS

The symptoms of Zika are similar to those of dengue and chikungunya diseases spread through the same mosquitoes that transmit Zika. Based on the typical clinical features, the differential diagnosis for Zika virus infection is broad. In addition to dengue, other considerations include leptospirosis, malaria, rickettsia, group A streptococcus, rubella, measles, and parvovirus, enterovirus, adenovirus, and alphavirus infections (e.g., Chikungunya, Mayaro, Ross River, Barmah Forest, O’nyong-nyong, and Sindbis viruses).

Preliminary diagnosis is based on the patient’s clinical features, places and dates of travel, and activities. Laboratory diagnosis is generally accomplished by testing serum or plasma to detect virus, viral nucleic acid, or virus-specified immunoglobulin M and neutralizing antibodies.

During the first week after onset of symptoms, Zika virus disease can often be diagnosed by performing reverse transcriptase-polymerase chain reaction (RT-PCR) on serum. Virus-specific IgM and neutralizing antibodies typically develop toward the end of the first week of illness; cross-reaction with related flaviviruses (e.g., dengue and yellow fever viruses) is common and may be difficult to discern. Plaque-reduction neutralization testing can be performed to measure virus-specific neutralizing antibodies and discriminate between cross-reacting antibodies in primary flavivirus infections.

However, at present there are no commercially available diagnostic tests for Zika virus disease. Zika virus testing is performed at the CDC Arbovirus Diagnostic Laboratory and a few state or local health departments. (See CDC, Instructions for submitting diagnostic specimens to the Division of Vector-Borne Diseases Arbovirus Diagnostic Laboratory.)

COMPLICATIONS OF ZIKA INFECTION IN PREGNANCY

Brazil has been having a significant outbreak of Zika virus since May 2015. Officials in Brazil have also noted an increase in the number of babies with congenital microcephaly during that time. Congenital microcephaly is often a sign of the brain’s not developing normally during pregnancy. Health authorities in Brazil, with assistance from the Pan American Health Organization, CDC, and other agencies, have been investigating the association between Zika virus infection and microcephaly.

Microcephaly is a condition where a baby’s head is much smaller than expected. During pregnancy, a baby’s head grows because the brain grows. Microcephaly can occur because a
baby’s brain has not developed properly during pregnancy or has stopped growing after birth, resulting in a smaller head size. Microcephaly can be an isolated condition, meaning that it can occur with no other major birth defects, or it can occur in combination with other major birth defects.

Babies with microcephaly can have a range of other problems, depending on how severe their microcephaly is. Microcephaly has been linked with the following problems:

- Seizures
- Developmental delay, such as problems with speech or other developmental milestones (such as sitting, standing, and walking)
- Intellectual disability (decreased ability to learn and function in daily life)
- Problems with movement and balance
- Feeding problems, such as difficulty swallowing
- Hearing loss
- Vision problems

These problems can range from mild to severe and are often life-long. Because the baby’s brain is small and underdeveloped, babies with severe microcephaly can have more of these problems, or have more difficulty with them, than babies with milder microcephaly. Severe microcephaly also can be life threatening. Because it is difficult to predict at birth what problems a baby will have from microcephaly, babies with microcephaly often need close follow-up through regular check-ups with a healthcare provider to monitor their growth and development.

**TREATMENT**

There is no specific medicine to treat Zika infections. Treatment therefore is geared toward relieving the symptoms by having the patient:

- Get plenty of rest.
- Drink fluids to prevent dehydration.
- Take medicine such as acetaminophen to relieve fever and pain.
  - Do not take aspirin and other non-steroidal anti-inflammatory drugs.
- Prevent mosquito bites for the first week of illness.

**PREVENTION**

No vaccine exists to prevent Zika virus disease. Therefore, prevention is of vital importance in preventing the spread of the disease.

During the first week of infection, Zika virus can be found in the blood and passed from an infected person to a mosquito through mosquito bites. An infected mosquito can then spread the virus to other people.

- Prevent Zika by avoiding mosquito bites (see below).
- Mosquitoes that spread Zika virus bite mostly during the daytime.
- Mosquitoes that spread Zika virus also spread dengue and chickungunya viruses.
- Prevent sexual transmission of Zika by using condoms or not having sex

When traveling to countries where Zika virus or other viruses spread by mosquitoes are found, take the following steps:

1. Wear long-sleeved shirts and long pants.
2. Stay in places with air conditioning or that use window or door screens to keep mosquitoes outside.
3. Sleep under a mosquito bed net if you are in a Zika area and are not able to protect yourself from mosquito bites.
4. Use Environmental Protection Agency (EPA)-registered insect repellents. When used as directed, EPA-registered insect repellents are proven safe and effective, even for pregnant and breast-feeding women.
   a. Always follow the product label instructions.
   b. Reapply insect repellent as directed.
   c. Do not spray repellent on the skin under clothing.
   d. If you are also using sunscreen, apply sunscreen before applying insect repellent.
5. If you have a baby or child:
   a. Do not use insect repellent on babies younger than 2 months of age.
   b. Dress your child in clothing that covers arms and legs, or
   c. Cover crib, stroller, and baby carrier with mosquito netting.
   d. Do not apply insect repellent onto a child’s hands, eyes, mouth, and cut or irritated skin.
   e. Adults: Spray insect repellent onto your hands and then apply to a child’s face.
6. Treat clothing and gear with permethrin or purchase permethrin-treated items.
   a. Treated clothing remains protective after multiple washings. See product information to learn how long the protection will last.
   b. If treating items yourself, follow the product instructions carefully.
Do NOT use permethrin products directly on skin. They are intended to treat clothing.

POSSIBILITY OF SPREAD TO MOSQUITOES IN THE UNITED STATES

As of the end of April, 2016 there have been no recorded cases of transmission of mosquito-to-human Zika in the continental United States. However there have been 426 confirmed travel-related cases; twenty-nine of these in California. The possibility of spread within the continental U.S. depends on the range of the mosquitoes that can carry Zika. (see illustration I) *Aedes aegypti* is found in about the southern one-half of the states including north of the San Francisco Bay Area and up to New York City. *Aedes albopictus* has a broader range, including all the states east of the Mississippi River and north of the Bay Area in California. Therefore, the possibility of spread in the U.S. exists, particularly in Florida, which has the highest number of introduced cases.

In Puerto Rico, however, there is a severe epidemic of locally acquired cases, 683 as of the end of April, 2016. One death occurred in April due to immune thrombocytopenic purpura. This condition has caused several deaths in other countries.

ZIKA AND THE OLYMPICS IN BRAZIL

The 2016 Olympics took place in winter in Brazil, when the risk of infection was expected to be low since it was in the dry season and colder. “It’s a time of the year for low transmission of mosquito-borne diseases in Rio de Janeiro,” says Dr. Maurício Lacerda Nogueira, an infectious-disease researcher based in Brazil.
However, Rio’s organizing committee recommended that athletes and spectators do whatever they could to avoid mosquito bites during the Olympics. The suggestions include wearing long-sleeved pants and shirts while outside, staying in air-conditioned rooms, and using insect repellent. The Olympic organizing committee inspected the venues every day for stagnant water.

Most Olympians insist they trusted the U.S. Olympic Committee, which named three infectious disease specialists to an independent advisory group that drew up Zika recommendations and guidelines for the Olympians.

CONCLUSION

Zika disease is of concern because of complications, particularly microcephaly, in fetuses of infected mothers, as well as occasional Guillain-Barré syndrome and thrombocytopenia in adults. The disease, which is transmitted by mosquitoes, has spread recently to South and Central America and the Caribbean Islands.

Only about 1 in 5 people who have been bitten by infected mosquitoes get sick. Most of the illnesses are mild and are treated symptomatically. The primary concern is to prevent Zika in pregnant women. Men who have travelled to countries where the disease occurs should abstain or have only protected sex with their partners who are pregnant or who are of childbearing age, since Zika can be spread sexually.

There is real concern that, since the transmitting mosquitoes occur in the southern half of the country and up to the northeast, it will become endemic in the United States. Knowledge of multiplication patterns of mosquitoes and how to avoid mosquito bites is important along with being informed about occurrences of the disease in the United States.

ILLUSTRATION I
REFERENCES
1. www.CDC.GOV

REVIEW QUESTIONS:
COURSE # DL-014
Choose the one best answer:

1. The principal species of mosquito that transmits the Zika virus is:
   a. Aedes aegypti
   b. Culex pipiens
   c. Aedes albopictus
   d. Anopheles quadrimaculatus

2. Which of the following is not related to Zika virus?
   a. chikungunya
   b. yellow fever
   c. dengue
   d. hantavirus

3. Zika virus was first identified in:
   a. Brazil
   b. Uganda
   c. South Pacific Islands
   d. Kenya

4. The principal treatment for Zika disease is:
   a. trimethoprim sulfa
   b. penicillin
   c. symptomatic
   d. amantadine

5. The symptoms of Zika infection include all but which of the following?
   a. rash
   b. diarrhea
   c. conjunctivitis
   d. muscle aches
6. Complications to the fetus of an infected pregnant woman include:
   a. microcephaly
   b. jaundice
   c. deformed limbs
   d. hepatomegaly

7. In laboratory tests for Zika infection there may be cross-reaction with:
   a. chikungunya
   b. yellow fever
   c. malaria
   d. sindbis

8. The state with the highest number of introduced Zika cases is:
   a. California
   b. Texas
   c. Georgia
   d. Florida

9. Prevention of Zika virus disease includes all but which of the following:
   a. protected sex with a man who has been in a country with Zika disease
   b. avoiding contact with a person infected with Zika disease
   c. avoiding mosquito bites
   d. elimination of standing water in small containers

10. Microcephaly in infants may cause all but which of the following:
    a. developmental delays
    b. hearing loss
    c. jaundice
    d. seizures