ZIKA VIRUS

WHAT PARAMEDICS NEED TO KNOW

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Introduction

Zika Virus Disease (ZVD) is a viral illness spread primarily through the bite of infected Aedes mosquitos. Human infection with the Zika virus typically presents with mild flu-like symptoms lasting two to seven days. Most recently, the Zika virus has been linked to birth defects triggering the World Health Organization (WHO) to declare ZVD a Public Health Emergency of International Concern.(1) Although symptoms are typically mild, it is important that the paramedic has a comfortable working knowledge of ZVD transmission, presentation and steps for personal protection. This review will provide a brief overview of the history of ZVD, epidemiology, prevention, clinical presentation, management and complications to help better prepare the paramedic for potential encounters with patients with ZVD.

Epidemiology

Although only recently gaining worldwide media attention, the Zika virus was first discovered in 1947. Isolated from the blood of rhesus monkey in the Zika forest of Uganda, the disease quietly spread throughout tropical Africa, Southeast Asia and the Pacific Islands.(1)

Human infection with the virus was not believed possible until a 1952 survey of various regions in Uganda found that 6.1 per cent of the population had serum antibodies for the virus.(2) These findings suggested that infection with the Zika virus was common and frequent. Additional surveys of Egypt, East Africa, Nigeria, India, Thailand, Vietnam, the Philippines and Malaysia revealed a much broader spread of the Zika virus than initially believed.(2)

In 1953 the first human case of Zika virus was discovered in three sick individuals in Nigeria. Zika was now officially confirmed in humans.(2) For the next 50 years Zika infections were rare and only 14 cases were confirmed worldwide.(1,2) The first known Zika outbreak occurred in 2007 on the Pacific island of Yap. More than 900 inhabitants of the small island had illness which was attributable to Zika virus. (3) No deaths or hospitalizations were attributable to the suspected Zika cases in 2007 and symptoms appeared to be mild in nature. (3) Early in 2013 and 2014 four separate Zika outbreaks were reported in other Pacific islands leading to thousands of confirmed infections. (1,2) The largest of these outbreaks occurred in French Polynesia with over 32,000 individuals undergoing evaluation for Zika virus disease.(2) The outbreak in French Polynesia was the first time that cases of Guillain-Barre syndrome was associated with Zika virus infection.(1-4)

The presence of the Aedes mosquitos and the climate in South America allowed the Zika virus to erupt in Brazil in March of 2015. (1,2,5) Between March and December of 2015 over 1.3 million suspected cases of ZVD were reported throughout Brazil.(1,2,5) An unrelated outbreak occurred in Columbia in October 2015 with over 50,000 suspected ZVD cases reported by March 2016.(2,5) As of April 2016, there have been reports of Zika virus in 66 different countries throughout the world.(1) The Public Health Agency of Canada has confirmed travel-related cases of Zika virus from Central and South America, and from the Caribbean, as well as newly diagnosed sexually-transmitted cases. As surveillance for the disease increases, there are suggestions that the incidence of Zika virus disease in the population may have been underreported, especially in areas with endemic dengue and chikungunya.(2)

Brazil began to report, in March of 2015, an increasing number of cases of neonatal microcephaly in areas with Zika virus outbreaks.(2,6) This link was further supported when Zika virus was found in amniotic fluid of patients then born with microcephaly.(7) Retrospective analysis has also demonstrated an increased number of microcephaly cases in French Polynesia during the 2007 Zika outbreaks.(6,8) Although it has been suggested that the numbers of microcephaly from Zika virus infection is overstated (2,6) there is still a significant world health risk and in February of 2016 the World Health Organization declared the Zika virus a Public Health Emergency of International Concern.(1)

Viral Transmission

Initially, Zika virus transmission was only believed to be through mosquitos.(1,2,5) Recent evidence suggests that transmission is also possible through other means as well. (2,6,9) Outlined is a brief discussion of the various methods of Zika virus transmission.

Mosquito Transmission - The majority of Zika virus transmission is through mosquitos in a Host-Mosquito-Host pattern.(2) In the forest regions of Africa, this typically involves non-human primates and transmission to humans in sporadic. However in urban environments such as in the Brazilian and Columbian epidemics, the intermediate host is typically human.(2) The mosquito species Aedes aegypti and Aedes albopictus are responsible for the majority of the virus transmission, although transmission by other mosquito species has been reported.(10)

A human can be infected after being bitten by a mosquito which contains the Zika virus. The human then acts as a reservoir for the Zika virus. Subsequent bites from mosquitos can transfer this infection to the mosquito and then to another human.(2) The A. aegypti mosquito is considered extremely likely to transmit the disease as it lives in areas with close contact to humans and can bite multiple humans during one blood meal.(2) The A. albopictus can survive and is endemic in much more temperate climates than the A. aegypti and is therefore more likely to cause outbreaks in the Northern US or Southern Canada.(2)

Non-Mosquito Transmission – Non-mosquito transmission has been confirmed or suspected through sexual contact, blood transfusion, and perinatally.(2,6,9) A substantial amount of evidence suggests that peripartum transmission of the disease is possible.(2,6-8) The Zika virus has been isolated in fetal blood,

amniotic fluid, in brain tissue of children who were born with microcephaly and died shortly after, and in blood from miscarriage.(2,11) The virus appears to be able to evade the natural immune protection from the placenta and infect the fetus during development. The highest risk appears to be during the first trimester of pregnancy but, the risk factors for developmental abnormalities and microcephaly are not known at this time.(6,8,11)

Zika virus transmission has also been reported through sexual transmission with cases from recent travelers returning home.(12) Transmission through sexual contact appears to be possible even after the virus is no longer detectable in the blood.(12) Sexually transmitted cases have recently been identified in Canada.

Zika virus was found in donated blood in French Polynesia after the 2007 outbreak suggesting blood transfusions as another possible mode of transmission.(9) There have been no reported cases of Zika virus transmission through blood transfusion to date and increased screening in at-risk areas should prevent transmission through this route.(2,9)

Prevention

There are no vaccines or medications that can be taken to prevent ZVD in humans. Prevention of ZVD typically involves stopping disease transmission from mosquitos (vector control).

Preventing Mosquito Bites - Preventing mosquito bites is the best way to prevent Zika virus transmission13. The Centre for Disease Control and Prevention suggests a number of ways to avoid mosquito bites if you are living or working in high risk areas for the Zika virus. When indoors it is recommended that air conditioning and screens are used on windows and doors.(13) This can be extrapolated to the ambulance environment and vehicle air conditioning systems should be used to avoid mosquitos. Windows and doors should remain closed in areas with increased risk.

When working outdoors long sleeves and pants are recommended. Mosquitos can however still bite through clothing and it is recommended that clothing is treated with permethrin or other insect repellents.(13) The insect repellent should contain one of the following active ingredients: DEET, Picaridine, Oil of lemon, eucalyptus or IR3535 should be worn at all times. The higher the percentage of active ingredient in the insect repellent the longer the protection will last.(13,14)

If you are sleeping outdoors or spending extended time outdoors, mosquito nets and tents should be used. These tents and nets should also be treated with permethrin to help repel mosquitos. If possible, keep these tents and nets out of direct sunlight as this degrades the permethrin much quicker.(13,14) This advice is applicable to members of paramedic rescue and treatment teams who may be working outdoors for prolonged periods.

It is important to protect yourself from mosquito bites even if you become ill with Zika virus disease. Subsequent bites have the potential to transfer the virus to other people and therefore bed rest and prevention of additional bites is important.(13,14) People are most at risk for transmitting the disease during the first week of the illness.(14) If you are treating a patient who is in their first week of Zika virus disease extra care must be taken to avoid mosquito bites, and to ensure vigilance with handling of biological waste. This is even more important if you are in an environment with extended patient contact times or if you are working outdoors as paramedics are likely to be.

Personal protection in the prehospital setting – At this time there is no known increased risk to paramedics from patients who are symptomatic compared to those who are asymptomatic.(2) There have been a small number of cases from needle stick injuries in a laboratory infection and enhanced vigilance is important with all sharps, handling of blood and other biological waste.(9,15,16) Standard precautions should also be taken when caring for patients with suspected ZVD. High-risk procedures such as invasive airway management, venepuncture or haemorrhage control should be performed with an increased level of protection to prevent exposure to biological substances. Quarantine or isolation is not recommended in the care of ZVD cases at present.

Clinical Presentation

The majority (80 per cent) of individuals who are infected with the Zika virus do not exhibit any symptoms.(2,3) The incubation period is currently unknown but is believed to be similar to other mosquito borne illness at one week.(2) When symptoms do develop they tend to be mild in nature and last a few days to a week in duration. There are small differences in presentation and recognition when screening adults, infants and children, and neonates for ZVD.

Adults – Characteristic findings in adults are a pruritic rash which usually begins on the trunk and spreads towards the face and extremities (Figure 1), acute onset of a low grade fever, conjunctivitis (non-purulent) and joint pain (arthralgia). Other less commonly reported symptoms include muscle aches (myalgia), headaches, retro-orbital pain, edema and vomiting.(2) The Pan American Health Organization developed guidelines for screening of patients with suspected Zika virus (Figure 2).

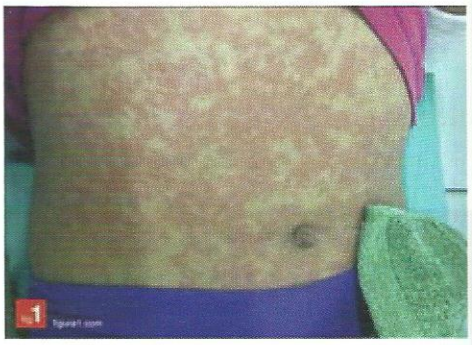

Figure 1: Pruritic rash characteristic of Zika Virus Disease. (Image courtesy of figure1.com)

Suspected case of Zika virus disease:

Patient with a rash* with two or more of the following signs or symptoms:

- Fever, usually <38.5°C
- Conjuctivitis (non-purulent/hyperemic)
- Arthralgia
- Myalgia
- Peri-articluar (around joints) edema

*usually prirtic and maculopaplar

Figure 2: PAHO guidelines for susected case of ZVD

Infants and Children – The majority of infants children, like adults, are also asymptomatic for the disease. When they do exhibit symptoms clinical findings tend to be comparable to those of adults infected with the Zika virus. Fever, rash, conjunctivitis and arthralgia are common.(17) Case reports from Yap Island reported a higher incidence of gastrointestinal symptoms but the sample size is very small and it is unknown if this is representative of ZVD in children.(17) Clinical evaluation of the infant and child with suspected ZVD is similar to evaluation in adults. Arthralgia can present as irritability, difficulty walking, pain on palpation or with passive movement of a limb, or refusing to move a limb due to pain.(18)

Neonates – There have been documented cases of perinatal Zika virus transmission from mothers who were recently infected with the Zika virus.(17,18) ZVD in the neonate presents with similar symptoms to that of the infant or child with ZVD, but again specific care should be taken when examining the neonate for signs of arthralgia. When screening the neonatal patient for ZVD, examination and questioning of the mother is also important. ZVD should be considered in neonates in the first two weeks of life if their mother traveled to or resided in an affected area within 2 weeks of delivery AND has two or more of the following: fever, rash, conjunctivitis or arthralgia.

Management

Management of the uncomplicated ZVD infection in humans is primarily management

of symptoms.(2,17,18) Fluids can be used to treat the dehydration associated with the infection. Acetaminophen is useful for treatment of both the fever, headache, arthralgia and myalgia. It should be noted that until dengue fever can be definitively ruled out, NSAIDs should not be used as they can increase the risk of haemorrhagic complications.(17,18) In addition to managing symptoms, the patient should be educated on proper prevention of future mosquito bites to decrease the risk of local transmission of the disease.

Complications

There have been two major types of complications that have been linked both temporally and geographically to Zika virus infection in humans: neurological complications and complications of fetal development2.

Neurological Complications

The most significant neurological complication associated with ZVD is Guillain-Barré Syndrome (GBS). Guillain-Barré syndrome is an autoimmune disease that results in the destruction of peripheral neurons in the body. (4) Symptoms of GBS include paresis or paralysis in the arms and legs, usually on both sides. In severe cases of Guillain-Barré individuals can have paralysis of nerves responsible for respiratory function, blood pressure regulation and heart rate. A case-control study on the Zika outbreak in French Polynesia found a significant increase in cases of GBS during the outbreak period.(5) Of the individuals who developed GBS, 100 per cent of the patients in the study had neutralizing antibodies against the Zika virus.(5) No patients with GBS secondary to a Zika virus infection died during the study period but 29 per cent of the patients did require respiratory assistance. The Brazilian Ministry of Health has also reported an increase in cases of GBS since the onset of the Zika virus outbreak.(2) Although the treatment doesn't change for cases of GBS as a result Zika virus infection, it is important to recognize the Zika virus as a possible precipitating factor when gathering your patient history.

Complications of Fetal Development

Although microcephaly appears to be the most publicly known complication of Zika infection, there have been a number of other serious fetal complications as well.(19) Microcephaly is abnormally small fetal brain development and there is growing evidence of a link between Zika virus infection during pregnancy and microcephaly occurring.(5,17) Zika virus infection also is associated with other developmental abnormalities such as: brain atrophy and asymmetry, hydranencephaly (parts of the cerebral hemispheres are missing with excess CSF), ventriculomegaly (dilation of cerebral ventricles), cerebral calcifications, abnormally or absent brain structures, bilateral cataracts, intraocular calcifications and hydrops fetalis (edema in fetal compartments). Post-partum complications have also included ophthalmologic and neurologic complications such as seizures, hypertonia and dysphagia.(17) In addition to developmental complications, there is a documented increased risk of miscarriage in mothers infected with the Zika virus.(2,17,18) Currently, there is no understanding as to what puts some mothers infected with the Zika virus at higher risk of developmental complications than others.

When caring for very young patients who have suspected complications from maternal Zika virus infection, it is important that the paramedic is prepared for potential outcomes. With an increased risk of seizures and choking the paramedic should prepare to manage these complications as they arise.

Conclusion

What was once a mosquito borne illness that lived in relative obscurity, has become a world wide health crisis in just over one year. Although the cause of the recent surge of Zika virus infection is unknown, research is ongoing and we continue to learn more about the virus,

infection and complications. As new research is released it is important that paramedics and other health care professionals continue to educate themselves so that they can provide the best care and education for their patients to help keep them and others safe. It is recommended that paramedics keep themselves appraised of changes and updates in the spread of ZVD through accessing the resources outlined below on a regular basis.

Resources

More information about the Zika virus can be found at the following resources:

- Centre for Disease Control and Prevention (CDC): http://www.cdc.gov/zika/
- World Health Organization (WHO): http://www.who.int/mediacentre/factsheets/zika/en/
- CDC Prevention Guidelines: http://www.cdc.gov/zika/prevention/index.html
- CDC Guidelines for Travellers: http://www.cdc.gov/chikungunya/pdfs/fs_mosquito_bite_prevention_travelers.pdf
- CDC Guidelines for Healthcare Providers who take care of Infants and Children: http://www.cdc.gov/zika/hc-providers/qa-pediatrician.html
- Official WHO Zika Virus App:
  - IPhone: https://itunes.apple.com/en/app/who-zika-app/id1090088404?mt=8
  - Android: https://play.google.com/store/apps/details?id=com.universaldoctor.zika

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