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Zika Virus

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Introduction.

Zika virus infection, a mosquito-borne flavivirus that causes febrile illness associated with rash, has been rapidly emerging in the Western Hemisphere over the past few months. The virus was rarely identified until outbreaks occurred on Yap Island in the Federated States of Micronesia in 2007, Fresh Polynesia in 2013, and Easter Island in 2014 (Chen & Hamer, 2016). The virus was initially detected in Brazil in 2015, in the northeast, and was subsequently identified in other states and several South American countries, including Colombia, Ecuador, Suriname, Venezuela, French Guyana, and Paraguay. Local transmission has been documented in Central America in countries such as Panama, El Salvador, Honduras, and Guatemala and in the Caribbean countries of Martinique, Puerto Rico, Dominican Republic, Haiti and Mexico (Chen & Hamer, 2016). Transmission of the virus has also been detected in travelers returning from infected regions to nonendemic countries, including United States, Canada, Japan, and Western Europe (Chen & Hamer, 2016).

Zika virus has recently spread in the American region according to the Center of disease control and prevention Arboviral Disease Branch, Zika virus disease and Zika virus congenital infection are now nationally notifiable conditions. With World Health Organization now reporting that Zika virus is now considered a Public Health Emergency of International Concern. As of between January 01, 2015 to June 29, 2016 in the United State States there were no locally acquired mosquito-borne cases reported , with 934 travel-associated cases , 1 laboratory acquired case to a total of 935 cases. This included 13 sexual transmitted and 4 Guillain-Barre syndrome cases. With United State territories reporting 2,020 locally acquired cases, 6 travel- associated cases and 10 Guillain- Barre syndrome cases (CDC, 2016).

As a nurse I was drawn to this topic for the mere fact that there is now an emergence of a pandemic virus that has the potential of causing microcephaly and for which there is no current or rather ready clinical diagnostic work-up, preventive vaccine. It's vital to educate patients across the health spectrum especially women of child bearing age on the prevention and risks associated with this pandemic virus(CDC,2016).

Signs and Symptoms.

While the incubation period of Zika virus is not yet clear, it's likely thought to be between three to twelve days after the bite of an infected mosquito, with 60% to 80% of the infections remaining asymptomatic. The signs and symptoms of Zika virus are usually mild and the disease is usually characterized by a short- lasting self- limiting febrile illness of four to five days duration without severe complications, with no associated fatalities and a low hospitalization rate (Lazic, s, 2016).

Signs and Symptoms

· Macular or papular rash- face towards rest of body
· Fever
· Arthralgia
· Non- purulent conjunctivitis/ conjuctival hyperanemia (red eyes)
· Myalgia
· Headache
· Rarely- gastrointestinal signs and retro-orbital pain

Complications

Autoimmune, neurological and neurodevelopmental conditions such as Guillain-Barre syndrome and microcephaly in fetuses and newborns from mothers possibly exposed to Zika virus in the first two trimesters of pregnancy (Lazic, s, 2016).

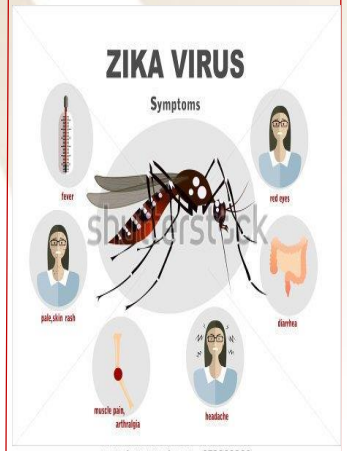

Figure 1. http://watchmengestcontrol.com

Underlying Pathophysiology.

Mosquito- mediated transmission of Zika virus is initiated when a blood-feeding female Aedes mosquito injects the virus into the human skin followed by viral replication initially in dendritic cells near the site of inoculation and subsequent spreading to lymph nodes and the blood stream. Zika virus infection of epidermal cells induces the appearance of cytoplasmic vacuolation indicative of cell apoptosis. With suggestions, that the flaviviral replication occurring in cellular cytoplasmas well as presence of Zika virus antigens in infected cell nuclei. Infectious Zika virus has been detected in human blood as early as the day of illness onset or as late as eleven days after onset. The outcome of viral infection is determined by a competition between viral replication and the host immune response (Al- Qahtani et al., 2016).

While detailed Zika virus pathogenesis is still unknown, emerging evidence seems to state that Zika Virus after being injected through the skin, gains access initially to immature dendritic cells , dermal fibroblast, and epidermal keratinocytes. Adhesion factors such as DC- SIGN, AXL, Tyro3, and TIM-1 help entry in these cells. With the help of envelope protein (E-protein), the virion attaches to the targeted cells. Then by the process of endocytosis with assistance from clathrin-coated pits, the virion enters the cyplasm of the cells. Replication occurs primarily in the cellular cytoplasm though Zika Virus RNA has been isolated from the nucleus. Then the cells undergo apoptosis and autophagy causing the release of virus particles, which ultimately spread to the lymphatics and blood stream leading to the florid manifestation of the disease. This leads to the host innate immune system to produce type 1 and type 2 interferons to which the Zika Virus is susceptible (Hajra et al., 2016).

Zika Virus is an arbovirus member of the Spondweniserocomplex within the genus Flavivirus, family Flaviviridae. Other members of flaviviruses include Yellow fever virus, Dengue virus (DENV), japanese encephalitis virus (JEV), Tick- borne encephalitis virus and Murray valley encephalitis virus (MVEV). Similar to other members of the Flavivirus genus, Zika Virus contains a positive single stranded genomic RNA, encoding a polyprotein that is processed into three structural proteins; the capsid (C), the precursor of membrane (prM) and the envelope (E), and seven nonstructural proteins NS1 to NS5(Al- Qahtani et al., 2016).

Zika Virus:

· Transmitted by the bite of a female infected Aedes mosquito mainly the Aedesaegypti
· Same mosquito known to transmit yellow fever, dengue and chikungunya viruses
· These mosquitoes become infected when they feed on an infected human and the virus continues to spread when the infected mosquitoes bite other people (Lupton, K, 2016).
· Zika virus as with any blood –borne pathogen can be transmitted via contaminated blood transfusion, through sexual contact and perinatal transmission from mothers to newborns (Al- Qahtani et al., 2016).

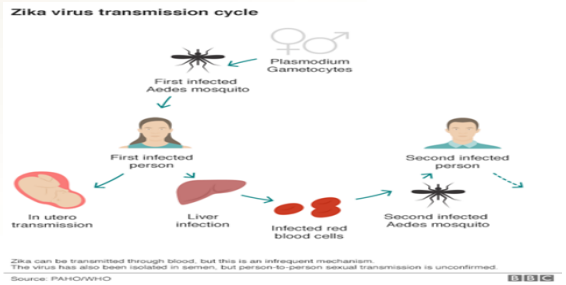

Figure 2. Zika virus transmission cycle by PAHO/WHO,2016

Significance of Pathophysiology.

Zika virus was named as such because it was first identified in a rhesus monkey in the Zika forest of Uganda in 1947. The virus was later found in humans with febrile illnesses in West Africa in 1954, then later spreading to Indonesia, Micronesia, Thailand, the Philippines, French Polynesia, and the Easter Island- South Pacific in 2014(Petersen et al., 2016).

The first ever case of Zika virus disease in Brazil was reported in May 2015 and since then, the virus has rapidly spread within Brazil and across 22 other countries and territories in the region. The Zika virus outbreak in Brazil is unusual, in that, alarmingly it has been associated with a large rise in the number of babies born with microcephaly and other neurological complications. The rapid spread of Zika virus in Brazil and the Americas is also of great concern since it joins the growing list of re-emerging infectious diseases, and its epidemic potential poses challenges for public health preparedness and surveillance for the 2016 Olympics and Paralympic games (Petersen et al., 2016).

While research into the association between Zika virus infection and Guillain-Barre syndrome (GBS) is still ongoing, a relationship between the two has been suggested due to higher than usual rates of Guillain-Barre syndrome (GBS) observed in French Polynesia, Brazil, and El Salvador during the recent outbreaks. With regards to congenital abnormalities, specifically microcephaly the Brazilian states with known Zika transmission have reported a greater than twenty- fold increase in rates of children born with microcephaly since the outbreak began. A recent case report of vertical Zika transmission identified viral RNA in the brain tissues of a fetus with severe microcephaly. While other reports have identified Zika RNA and antibodies in the amniotic fluid of micro cephalic fetuses from affected areas in Brazil, and although these findings do not prove causality between Zika virus infection and microcephaly, the link is now strongly supported by mounting epidemiologic and clinical data (BC medical journal, 2016)

Implications of Nursing Care

While research on Zika Virus is ongoing, finding answers to many of the questions surrounding Zika Virus infection is complicated by multiple factorssuch as the lack of large epidemiological studies, the continued need to evolve research and complex diagnostic testing with no current commercially available diagnostic tests for the infection, laboratory testing capacity is currently limited primarily to public health and research institutions (Bell et al., 2016).

With no means to prevent or treat Zika Virus, public health authorities will be limited to controlling the spread of the mosquitoes. While this task remains to be a difficult one, it requires cooperation of the population, especially in overcrowded and poverty stricken urban areas through efficient mosquito control measures, distribution of insecticides or clearing standing water must be done with regularity being required(Palomo, M A , 2016). Subsequently, the best way to prevent Zika Virus infection is to avoid mosquito bites by avoiding exposure and eliminating mosquito breeding areas. Until more is known, pregnant women should consider postponing travel to any area with ongoing Zika Virus transmission. Healthcare providers should contact their state or local health department about testing patients with symptoms of Zika Virus infection and a compatible travel history (Hennessey et al., 2016).

Additionally, World Health Organization recommends that all member states establish and maintain heightened awareness and capacity to detect and confirm Zika Virus cases, have healthcare facilities prepared to respond to a possible increased demand for specialized care for microcephaly and neurological syndromes, strengthen antenatal care, and introduce public health measures to reduce risk of Zika Virus spread and infection (Petersen et al., 2016).

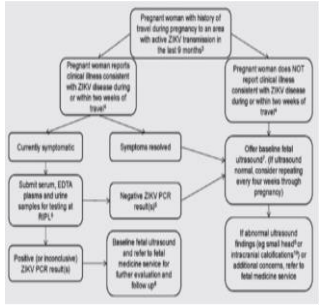

Figure 3. Algorithm for assessing pregnant women with a history of travel.
(source-RCOG/RCM/PHE/HPS clinical guidelines. Zika virus infection and pregnancy)[1]

Conclusion

Since Zika Virus remains to be acomplex disease to diagnose because of the small number of laboratory-confirmed cases, and because the disease is yet to be reported case by case, it is not possible to make accurate predictions of the expected number of microcephaly cases in Brazil or in the rest of the Americans, as the perspective seems bleak. That being said, researchers are working to produce robust evidence of the casual link to estimate the risk of congenital infection in pregnant women by gestational week at infection as well as to establish the severity and clinical progression of affected newborns, and to investigate the biology and interaction between virus and host and the physiopathology (Teixeira et al., 2016). With proper referral to a reproductive infectious disease clinic made for pregnant women returning from a Zika- affected area who have a positive test for Zika Virus infection or an ultrasound showing an abnormality consistent with congenital viral infection (BC medical journal, 2016).

In addition, while researchers are working to develop better diagnostic testing and a vaccine to better accrue knowledge and to develop effective and safe drugs for infected pregnant women and new technologies for vector control. However, understanding and addressing such unexpected, unpredicted, extreme, and rapidly expanding phenomenon requires a joint effort of the national and international scientific communities, public health policymakers, and funders. Otherwise, the world can only watch while this tragedy develops, compromising the cognitive and psychomotor development of a generation of children (Teixeira et al., 2016).

References Cited

Al- Qahtani, A.A., Nazir, N., Al- Anazi, M.R., Rubino, S., & Al-Ahdal, M.N. (2016).Zika Virus: A New Pandemic Threat. The Journal of Infection in Developing Countries, 10(3), 201-207
Retrieved from http://dx.doi:10.3855/jidc.8350

Bell, B.P., Boyle, c.a., & Petersen, L.R. (2016).Preventing Zika Virus Infections in Pregnant Women: An Urgent Public Health Priority.American Journal of Public Health, 106(4), 589-590.
Retrieved from http://dx.doi:10.2105/AJPH.2016.303124

British Columbia Center for Disease Control.(2016). Zika Virus: A summary. British Columbia Medical Journal, 58(3), 158-161

Center for Disease Control and Prevention (2016).Areas with Zika-United States. Retrieved from https://www.cdc.gov/zika/geo/united-states.html

Chen, L.H., & Hamer, D.H. (2016).Zika Virus: Rapid Spread in the Western Hemisphere. Annals of Internal Medicine Ann Internal Medicine, 164(9), 613-615.
Retrieved from http://dx.doi.10.7326/m16-0150

Hajra, A., Bandyopadhyay, D., &Hajra, S.K. (2016).Zika Virus: A Global Threat to Humanity: A Comprehensive Review and Current Developments. North American Journal of Nursing Medical Sciences, 8(3), 123-128.
Retrieved from http://dx.doi:10.4103/1947-2714.179112

Hennessey, M., Fisher, M., & Staples, J.E. (2016).Zika Virus Spreads to New Areas-Region of the Americas, May 2015- January 2016. American Journal of Transplantation, 16(3), 1031-1034.
Retrieved from http://dx.doi.10.1111/ajt.13743

Lazic, S. (2016).Another Emerging Pathogen-Zika Virus.VOJNOSANIT PREGL VojnosanitetskiPregled Military Medical and Pharmaceutical journal of Serbia VOJNOSANITETSKI PREG VSP, 73(3), 225-227.
Retrieved from http://dx.doi:10.2298/vsp1603225l

Lupton, K. (2016). Zika Virus Disease: A Public Health Emergency of International Concern. British Journal of Nursing, 25(4), 198-202.
Retrieved from http://dx.doi:10.12968/bjon.2016.25.4.198

Palomo, A.m.(2016). Zika Virus: An International Emergency? Journal of Public Health Policy, 37(2), 133-135.
Retrieved from http://dx.doi.10.1057/jphp.2016.11

Petersen , E., Wilson, M.e., Touch, S., Mccloskey, B., Mwaba, P., Bates, M., Zumla, A. (2016). Rapid spread of zika virus in the Americas-implications for public health preparedness for mass gatherings at the 2016 Olympic Games. International Journal of Infectious Diseases, 44, 11-15.
Retrieved from https://dx.doi:10.1016/j.ijid.2016.02.001

Teixeira, M.G., Costa, M.D., Oliveira, W. K., Nunes, M.L.,&Rodriques, L.C. (2016). The Epidemic of Zika Virus- Related Microcephaly in Brazil: Detection, Control, Etiology, and Future Scenarios. American Journal of Public Health, 106(4), 601-605.
Retrieved from http://dx.doi.10.2105/AJPH.2016.303113

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