



Bringing Home More than a Medal: An Olympian's Battle Following Zika Virus Infection

by

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Part I – The Story of Infection

Jessica was about to enter yet another doctor's office. The physician was not one whom she had seen before, so she knew she would need to provide a full account of the events that transpired so that he could help her.

"Jessica?"

"Yes, that's me!"

"Nice to meet you. I am Dr. Kits." They shook hands, and Dr. Kits sat down in the chair next to her. "Tell me what brings you here today." The physician already knew that Jessica made the front page of a national paper as a very rare case of an Olympic athlete who was infected with Zika virus and developed long-term complications. He was very curious to hear about her story in person, and to help manage her treatment.

"I'm an equestrian who traveled to the Olympics. I won the bronze medal, which was an amazing experience—one that I'll never forget! Unfortunately, while I was in South America, I suspect that I was bitten by a mosquito carrying the Zika virus. There was a lot of hype prior to the Olympics that Zika virus would be a major threat; other athletes chose not to travel and compete for this reason. However, the reports said the risk of getting infected was low, so there was no way that I would have passed up the opportunity without regretting it."

"That makes perfect sense. Tell me a little more..." said Dr. Kits.

Questions

1. Using your foundational knowledge of biology, describe in general how viruses infect cells. Are viruses alive?
2. In particular, how is the Zika virus transmitted? Refer to the Centers for Disease Control (2016) or another reliable reference.
3. What types of cells does Zika virus infect? Refer to Kruger (2016) or another reliable reference.
4. Make a statement about how likely it was for Jessica to become infected by Zika virus by traveling to the 2016 Summer Olympics. Refer to Lewnard et al. (2016) or another reliable reference.
5. Propose a rapid test that can be conducted to detect Zika virus infection in symptomatic individuals, or research and describe a test that is currently available. Consider the type of fluid to be tested, and that the test should be able to be easily performed in a doctor's office or at home. Do not be concerned about whether or not the test is covered by health insurance.

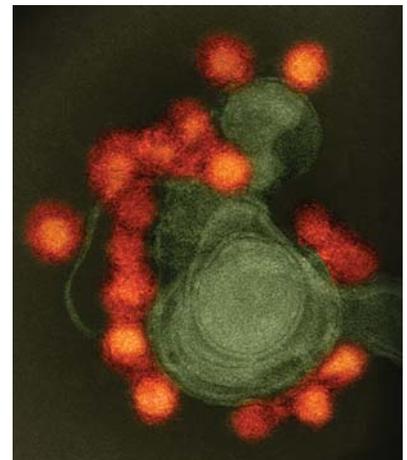


Figure 1. Transmission electron microscope image of negative-stained Zika virus (red).
Credit: NIAID, CC BY 2.0.

Part II – The Healing Process

Jessica continued, “I think I may have been bitten while tending to my horse Trailblazer. After the Olympics, I returned home to Miami and fell ill a few weeks later.”

“What were your symptoms?”

“I had a lot of joint pain. As time went on, I started to feel as though I couldn’t move parts of my body, somewhat paralyzed. My primary care doctor referred me to a neurologist, who diagnosed me with Guillain-Barré syndrome. I guess I’m just really unlucky. So that’s what brings me here today.”

“How are you feeling today?” asked Dr. Kits.

“Much better than I have been over the last few months. I can finally walk without assistance.”

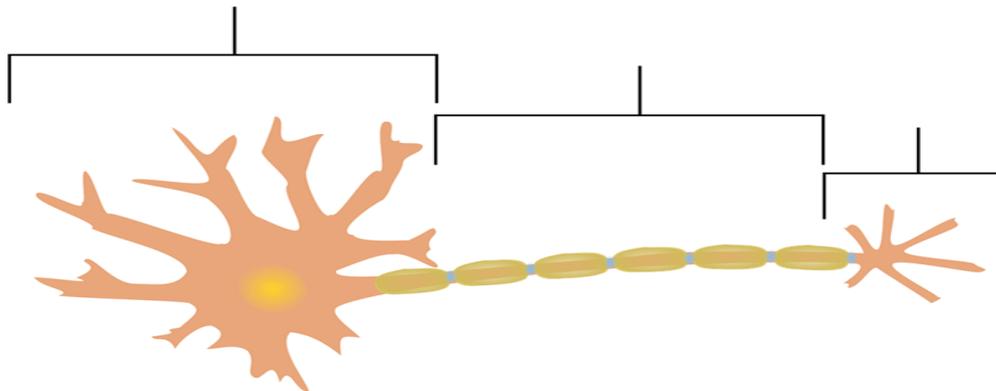
“Let’s have a look.” Dr. Kits performed a complete physical exam, which included a neurological exam. “Good, good,” he said as he moved from one test to the next.

“Jessica, you’re making good progress. Let’s continue monitoring your health with regular check-ups.”

“I’m so relieved. Thank you Dr. Kits. I’m hoping that one day I’ll be able to compete with Trailblazer again.”

Questions

1. Given that Jessica was bitten by a mosquito, what clinical evidence would convince a physician to diagnose her with Zika virus infection and rule out other common tropical diseases?
2. Give examples of symptoms that you would most likely expect given the different forms of Guillain-Barré syndrome.
3. Describe the role that the immune system plays in Guillain-Barré syndrome.
4. Describe the clinical progression of Zika virus infection to the development of Guillain-Barré syndrome. How often is Guillain-Barré associated with Zika virus infection and other viral infections?
5. As explored in this case, Guillain-Barré is a rare disease that affects the nervous system. Consider the multipolar neurons within the nervous system. They have segments that are classified as conductive, receptive and transmissive. Use the label lines above the neuron to identify these three segments. Create your own lines and labels below the neuron to identify the axon, axon terminal, cell body, dendrites, myelin sheath, node of Ranvier, and nucleus.



6. Briefly describe how nerve impulses are transmitted within a neuron, including the role of the myelin sheath.
7. Briefly describe how a neuron transmits a signal from its transmissive segment to its target cell.
8. Propose physiological symptoms that would most likely accompany the destruction of the myelin sheath in the peripheral nervous system. Explain.

Part III – More News

While Jessica recovered from Guillain-Barré she faced another challenge, this time with her baby's health. Jessica had not known that she was pregnant when she competed in the Olympics. At that time there were advisories telling pregnant women not to travel to South America during the Zika outbreak because of the increased risk of microcephaly in babies born of infected mothers.

When Jessica discovered that she was pregnant, she was immediately fearful. She could not help but worry that her baby might be infected. “This is so confusing, and everything is happening so fast,” thought Jessica. “With winning the Olympics, becoming infected with Zika virus, developing Guillain-Barré syndrome, and now finding out that I am pregnant, I don't know how to feel anymore.” Since Jessica was in the first trimester of pregnancy, her developing baby would undergo additional monitoring. The microcephaly risk was high when mothers were infected in the first trimester.

Each day of pregnancy that passed seemed like an eternity for Jessica. During the third trimester, ultrasound scans showed that her baby had a smaller than normal head circumference. “I can't believe all of this is happening,” she said after reviewing recent scans at the doctor's office. Jessica held her head in her hands and cried.

Questions

1. Define what is understood clinically by the term “microcephaly.” Besides Zika virus, what other maternal infections can also cause microcephaly?
2. Propose mechanism(s) by which infection with Zika virus could lead to microcephaly in fetuses. Use evidence from the literature to support your claims. *Hint:* Refer to the Hathway (2016) reference.
3. What is the likelihood that a baby whose mother is infected with Zika virus develops microcephaly? Should Zika infection be the only concern?
4. How might data collected on the incidence of microcephaly be an underestimate of the severity of Zika infection during gestation?
5. If Jessica's fetus was not infected with Zika virus during pregnancy, could the baby still be infected by the mother after birth? If so, how might such an infection occur postnatally, and how might the health outcomes be different than if the child were infected during pregnancy?
6. Prior to the Rio 2016 Olympics, a well-known male athlete expressed his disappointment at the withdrawal of several of the world's leading male golfers from the Games saying “I thought it was a disease that affected women more than it did men.” If he was right, would only the female competitors have needed to be concerned? Explain.

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