

**Host-Pathogen Interaction (Immunology)**  
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**Lecture-71**  
**Arbovirus and Zika Virus Infection**

Hi. So, in previous session we have discussed about arboviruses and we have learned how these arboviruses are coming to the human and what kind of diseases it is causing. I gave you some generalized clinical feature or symptoms when this arbovirus infects the human. And in previous session we have also discussed about dengue virus, which is a one of arbovirus and this basically occurs different levels of severity.

Some individual are asymptomatic or others are maybe they show a very severe symptom and that could be a life-threatening. So, in continuation of arboviruses, I am going to talk about Zika virus. So, I will just tell a bit about the Zika virus and then we will finish the arboviruses arbovirus and arboviral infections.

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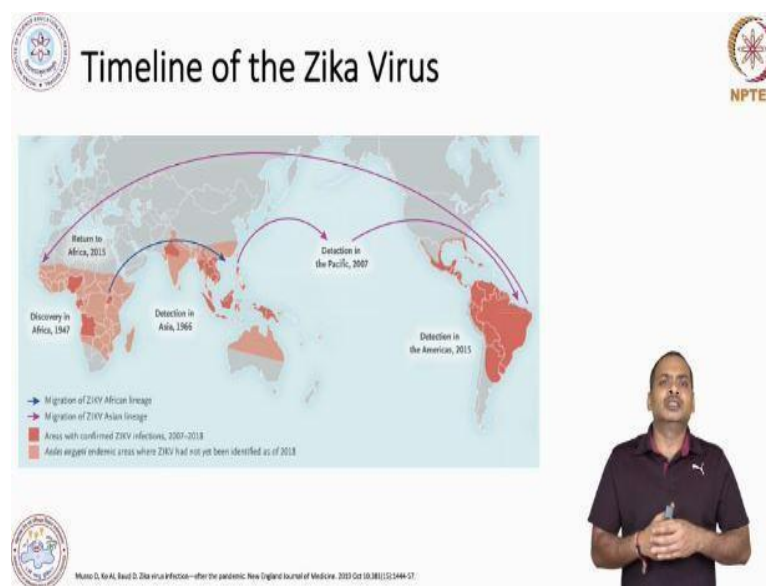
The slide is titled "Zika Virus" and features the IISER Bhopal logo in the top left and the NPTEL logo in the top right. It contains three bullet points: "ZIKV is a positive-sense RNA flavivirus in the family Flaviviridae", "ZIKV was first isolated in 1947 in the Zika Forest in Uganda, where transmission of the ancestral African lineage of ZIKV was limited to the enzootic circulation between nonhuman primates and sylvatic Aedes mosquitoes, with sporadic spillover infection to humans", and "Zika is also spread mostly by the bite of an infected Aedes species mosquito (*A. aegypti* and *A. albopictus*).". Below the text is a diagram of the Zika virus structure, showing a blue, spherical, segmented capsid with a central core of RNA. The diagram is labeled "Zika virus" at the bottom. A small inset photo of Prof. Himanshu Kumar is visible in the bottom right corner of the slide.

So, Zika virus is also positive-sense RNA; it is also flavivirus and the family is Flaviviridae. And Zika virus was first isolated in 1947 in Zika forest in Uganda. So, this Zika forest is in Uganda, where transmission of ancestral African lineage of Zika virus was limited to the enzootic circulation between non-human primates and sylvatic Aedes mosquitoes or in previous session we have discussed about there are enzootic cycle is there.

So, enzootic cycle is basically this is a transmission of virus between mosquito and non-human primate. So, generally in this circle; the life cycle is in between the mosquito and the non-human primate. So, Zika virus is basically following that this enzootic cycle but sometimes this mosquito infects the human; means bite the human and then this virus comes in the human.

So, therefore we can say that sometime there is a spillover infection to the human. So, here there is a very clear evidence that there is a enzootic cycle this virus is basically present in that enzootic cycle and then sometime it jump to the human when this mosquito bites the human, but for dengue it was not so clear. So, Zika is also spread mostly by the bite of an infected *Aedes* species; you know that it is *A. aegypti* and it is *Aedes albopictus*. So, these are the two key species of mosquito which basically transmit the virus.

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Here I am just showing the migration of Zika virus. So, if you follow up the blue line then you can see that this Zika virus there is a African lineage and this African lineage moved to the Asia and it was a so first it was reported in Africa in 1947 and in 1966 it was reported in Asia. So, it is very interesting to understand how this virus is moved from Africa to Asia. And here you can see that this infection is quite dominant in Asiatic region and this migration of Zika virus Asian lineage.

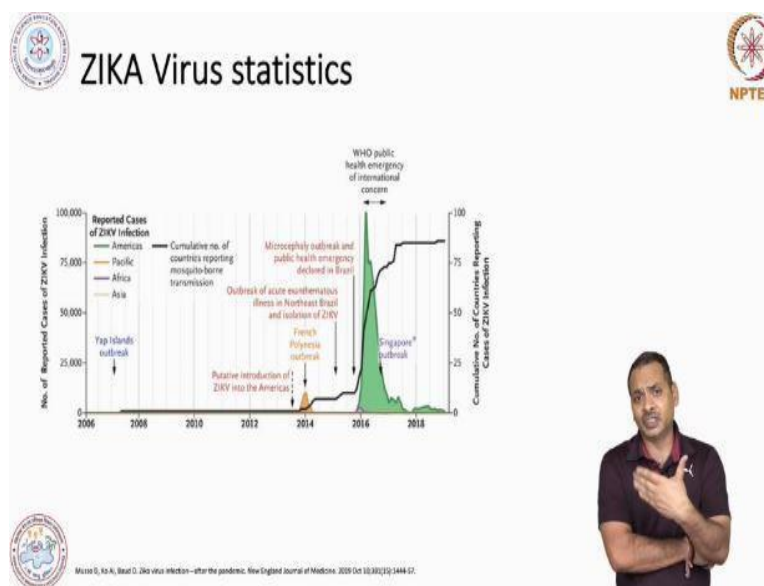
So, this Asian lineage moved from Asia to Pacific in 2007 and in 2015 it was also reported in America. And this American lineage is also reported in Africa. So, here you can see that how

the transportation or transmission of a virus is taking place. And if you see the timeline, so initially 1947 to 1966 it is a quite long duration but in recent year that is from 2007 this move from Pacific to the America. So, this is quite a short duration.

You can understand due to this ease in movement of human due to a lot of flights and all those things. So, the movement of these viruses is also quite fast. So, in 2015 it is reported in America and the same strain is reported in the Africa. So, you can understand the importance of movement of a human. So, this is not only improving the trade or economy of the country, but it also transports some which is not good, like a disease.

This due to this ease in transport, this disease is also quite frequently hopping from one continent to other continent and that is the reason the SARSas-Covid2 pandemic very rapidly is spreaded all over the world.

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So, Zika virus statistics, here you can see that in early years this was not causing a kind of an epidemic, but now in recent year there is an increase in epidemic. Here, you can see that in 2014 there is a French Polynesia outbreak, and there are several outbreaks, and if you see the number of cases in recent year, this is increased. Although, if you see carefully, from 2017 to 2019 it is a little plateau, however, there is a tendency to increase.

So, the number of Zika cases are increasing, so it is a point of worry. One has to really look at this thing and one has to address why this virus is increasing and the number of cases is increasing.

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The slide is titled "Zika Virus Transmission and Clinical Features" and includes the NPTEL logo in the top right corner. It is divided into three main sections:

- Modes of Infection:**
  - Mosquito
  - Sexual
  - Blood transfusion
  - Pregnancy
- Patient with Infection:**
  - Asymptomatic (50-80%)
  - Mild disease (20-50%)
  - Complications (<1%)
- Severe Complications:**
  - Neurologic: Guillain-Barré syndrome, acute myelitis, acute transient polyneuritis, meningoencephalitis
  - Ocular: hypopyon, iridocyclitis, unilateral acute maculopathy, bilateral posterior uveitis, chorioretinal scars
  - Thrombocytopenic purpura
  - Transient myocarditis
  - Overall case fatality <0.01% (mostly among immunosuppressed patients and those with comorbid conditions)

A presenter in a dark blue shirt is visible in the bottom right corner of the slide. At the bottom left, there is a small circular logo and a reference: "Hansen CJ, Ko AI, Boud D. Zika virus infection—after the pandemic. *New England Journal of Medicine*. 2019 Oct 23;381(17):1444-51."

So, Zika virus transmission and clinical features: So, basically, this virus infects the individual through mosquito bite; it can also infect through sexual means, blood transfusion, and pregnant women can also readily infect, as I told you in the previous session that the pregnant woman has a little high temperature and they attract the mosquito. So, probably that is one of the important reasons.

Patient with infection: Most of the patients are asymptomatic; about 50 to 80 percent are asymptomatic. So, this is good news, 20 to 50 percent of individuals show some mild symptoms, and a very small proportion of people, which is less than 1 percent, show severity and what are the severe complications.

So, the severity is mainly associated with a neurological thing and a muscular thing. So, neurologic is one of the diseases that occurs: the Guillain-Barré syndrome, acute myelitis, and acute transient polyneuritis. So, all these are associated with the dysfunctioning of neurons or spinal cord or myelin sheath, which is present over the neurons. Meningoencephalitis is the most likely of the meninges.

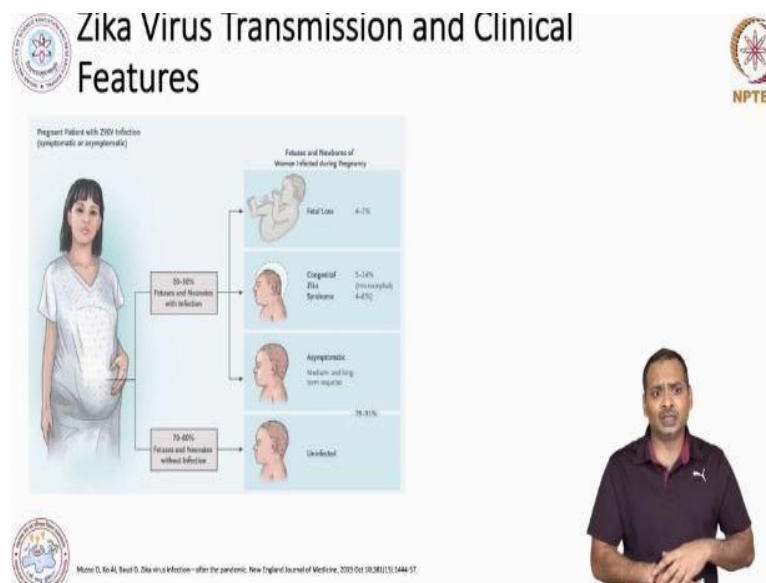
You know there are membranes: our brain ~~is~~ and spinal cord is covered by the membranes which we call it as meninges. So, there is an inflammation of brain meninges, so that is why there is meningoencephalitis. So, there is an inflammation of meninges. This virus also affects the eyes and there are various symptoms associated with the eyes, ocular, that is

hypertensive iridocyclitis, so this is a basically inflammation of ~~iris~~ **iris**, in eye there is a eye ratio, the coloured part.

There is a unilateral acute maculopathy, bilateral posterior uveitis and there is a chorioretinal scars. So, this is all associated with eyes. So, basically, it affects the eyes in a very simple word and these are more clinical terms. So, I told you a few of this. Basically, it affects or causes the inflammation on different component of eyes. There is a thrombocytopenia is a purpura and transient myocarditis it affects the heart also.

So, overall case for fatality is a less than 0.01 percent, mostly among immuno-suppressed patient and those with coexisting conditions. So, in case of ~~Sars~~ **Sars** ~~Covid~~ **Covid** ~~V2~~ **V2**, only not only most of the fatalities associated with those individual who are having some pre-existing disease like a cardiovascular disease or metabolic diseases or cancer or something like that. So, this is also true for Zika viruses. So, the individual who is having these pre-existing problems may be more severely affected by this virus.

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So, Zika virus transmission and clinical feature: So, basically the pregnant patient is more having rather than patient the developing fetuses is much more prone to this Zika virus infection; about 20 to 30 percent fetuses and neonates with infection they develop a various kind of problems like sometime it makes the fetal loss. It may also cause the congenital Zika syndrome and in some cases, there will be asymptomatic medium and long-term ~~sexually~~ **sexually** ~~sequelae~~ **sequelae** is also associated.

But, the good point is that this is very small portion, not a small portion. I can say that around one third of infection in pregnant women result to this kind of problem, but two third is basically or about 70 to 80 percent the pregnant woman, the fetuses is a kind of unaffected. So, there must be involvement of the health of the woman is also associated, maybe okay. I cannot say with a great confidence; maybe clinician can put more light on this point.

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The slide is titled "Congenital Zika Syndrome" and features a grid of images on the left side. The top row shows three fetal ultrasound scans. The middle row shows three photographs of newborn infants with various physical abnormalities. The bottom row shows three more photographs of infants, including one with a large head and another with a collapsed skull. To the right of the images is a list of clinical manifestations under the heading "Clinical manifestation".

**Congenital Zika Syndrome**

Clinical manifestation

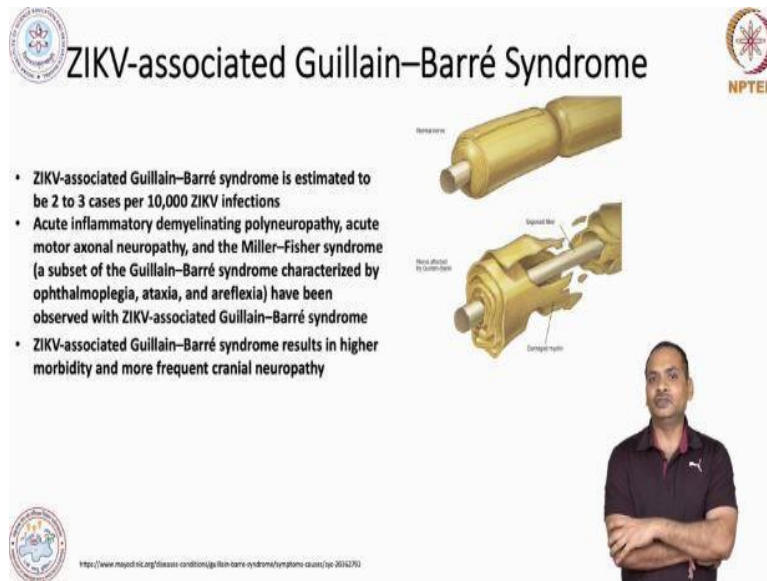
- Severe microcephaly
- Collapsed skull
- Redundant scalp skin
- Hip dislocations
- Development delay
- Visual impairment
- Deafness
- Body tone abnormalities

The slide also includes logos for the institution and NPTEL, and a small inset image of a man in a dark shirt with his arms crossed.

So, this congenital Zika syndrome is having a series of complications and clinical manifestations or symptoms. So, this is a severe microcephaly and collapsed skull, so if you see these symptoms you can understand that this virus is somehow affecting neuron, brain or head region cephalic region. There are redundant scalp skins; hip dislocation is also associated with this.

Development delay in fetus, visual impairment as you can see in this image deafness, body tone abnormalities. So, these are the some of the symptoms associated with Zika infection.

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**ZIKV-associated Guillain-Barré Syndrome**

- ZIKV-associated Guillain-Barré syndrome is estimated to be 2 to 3 cases per 10,000 ZIKV infections
- Acute inflammatory demyelinating polyneuropathy, acute motor axonal neuropathy, and the Miller-Fisher syndrome (a subset of the Guillain-Barré syndrome characterized by ophthalmoplegia, ataxia, and areflexia) have been observed with ZIKV-associated Guillain-Barré syndrome
- ZIKV-associated Guillain-Barré syndrome results in higher morbidity and more frequent cranial neuropathy

Normal nerve

Nerve affected by Guillain-Barré

Myelin Sheath

Damaged myelin

NPTEL

<https://www.mcgill.ca/zika/zika-associated-guillain-barré-syndrome/symptoms-causes/10042793>

So, Zika virus associated Guillain-Barré syndrome and here you can see that Zika virus associated Guillain-Barré syndrome is estimated to be 2 to 3 cases per 10,000 Zika virus infections. So, it is a quite low number, but still this is a point of concern. So, this is you can see that this is a normal nerve and this is a nerve from affected individual who is developing this syndrome and here you can see that there is a severe damage of myelin sheath and there is a expose of fiber.

So, acute inflammatory demyelinating polyneuropathy. So, it is affect a lot of all kinds of neuron peripheral neuron and other. There is acute motor axonal neuropathy and the Miller-Fisher syndrome a subset of Guillain-Barré syndrome characterized by ophthalmoplegia, ataxia, areflexia. So, these are more technical terms so just I thought to give you just an idea you need not to worry about more clinical terms, have been observed with a Zika virus associated Guillain-Barré syndrome.

Zika virus associated Guillain-Barré syndrome result in higher morbidity. So, it will cause the very poor life and frequent cranial neuropathy. So, all these things are associated with neurons. So, with this I will stop about the Zika virus. I just gave you a kind of quick overview about the Zika virus infection. And with this I finish the week 10 and now we will move to the week 11, where we will discuss about bacterial infection. And I will take Tuberculosis in more detail. Thank you.