Epidemiology of Arthritogenic Arboviruses Affecting Travelers

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What: Alphaviruses

Symptoms of alphaviral diseases

Why is clinician awareness of these diseases important?

- Disease burden
  - Common: Chikungunya
  - Less common: Ross River, Mayaro, O’nyong-nyong, Sindbis
- Geographically widely distributed

Potential for rapid spread
Travelers can be sentinels of infection

Traveler’s role in spread of infection

Chikungunya

- First recognized during outbreak in Tanzania in 1952–53
- ‘that which bends up’ or ‘to become contorted’ (Makonde language)

Transmission cycle

Sylvatic cycle

Acknowledgement for graphic: Dr. Ann Powers, CDC
Transmission cycle

Sylvatic cycle
- Aedes furcifer, Aedes africanus
- Chimpanzees, monkeys, baboons

Urban cycle
- Aedes aegypti
- Aedes albopictus
- Urban cycle
- Sylvatic cycle

Mosquito vectors

- Aedes aegypti
  - Identified by white stripes on bodies and legs
  - Aggressive daytime biters with peak dawn and dusk
  - Breed in containers that hold water

- Aedes albopictus

Transmission cycle

Acknowledgegnt for graphic: Dr. Ann Powers, CDC

Spread of chikungunya virus since 2004*

Chikungunya virus disease cases reported among travelers, United States, 2009–2018 –

Risk area for chikungunya virus transmission*

Travel destination for U.S. travelers with chikungunya virus disease, 2018–19*

*As of May 2018

*As of May 2018

Source: CDC

Source: CDC

Source: CDC

Source: CDC

* Preliminary data for 136 travelers reported to ArboNET with travel destination noted
Ross River virus infection

Ross River virus

- **First isolated:** Ross River, Townsville, Australia, 1959
- **Primary vectors:** Aedes and Culex species mosquitoes
- **Reservoir hosts:** Marsupials

Risk areas

- **Australia**
  - Average of 5,000 cases/year with periodic outbreaks
- **Papua New Guinea**
Additional risk areas – Pacific Islands region

- Large outbreak South Pacific in 1979–1980
- Locally, no outbreaks or cases reported since
- Data suggest Ross River virus might be established or be periodically reintroduced with local transmission
  - Traveler cases from 1997–2009 in tourists to Fiji
  - Serosurvey evidence in French Polynesia and American Samoa

Ross River virus infections in travelers to Australia

- Reported in small numbers but regularly

Mayaro virus infection

Mayaro virus

- First isolated: Mayaro County, Trinidad, 1954
- Primary vectors: *Haemagogus* species mosquitoes
- Reservoir hosts: Non-human primates

Countries with reported Mayaro cases

Human exposure and infection
Published cases in international travelers, 1996–2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Nationality</th>
<th>Travel destination</th>
<th>Reference</th>
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<tbody>
<tr>
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<td>United States</td>
<td>Peru</td>
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<td>1997</td>
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<td>2008**</td>
<td>Dutch</td>
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<td>Brazil (Amazon)</td>
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<td>2011</td>
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<td>Peru (Amazon)</td>
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<td>2014</td>
<td>German</td>
<td>Bolivia</td>
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*Probable case; **Possible infection in partner also infected

O’nyong-nyong virus and Sindbis virus infection

O’nyong-nyong*

First isolated: Uganda, 1959

Primary vectors: Anopheles species mosquitoes

Vertebrate hosts: Unknown

* ‘Very painful weakening of the joints’

Geographical distribution of O’nyong-nyong virus

Source: Rezza et al., 2017. Pathogens and Global Health

O’nyong-nyong cases in travelers

Sindbis

First isolated: Sindbis district, Egypt, 1952

Primary vectors: Culex, Aedes, and Culiseta species mosquitoes

Vertebrate hosts: Birds

O’nyong-nyong virus and Sindbis virus infection

Geographical distribution of O’nyong-nyong virus

Source: Rezza et al., 2017. Pathogens and Global Health

O’nyong-nyong cases in travelers

Sindbis

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Summary

- Chikungunya: most common disease causing arthralgia in tropical/subtropical areas
- Other alphaviruses to keep in mind
  - Australia and the Pacific: Ross River virus disease
  - Africa: O’nyong-nyong
  - South/Central America: Mayaro
  - South Africa, Northern Europe: Sindbis

Why are arboviruses emerging?

Human travel

- and covering greater distances with increasing speed
- allowing rapid transport of pathogens

Growth in tourist numbers

Spread of vectors

- Adaptable to a range of habitats
- Adaptable to cold temperatures

Source: Kraemer et al, 2015. eLife
International trade

Viral adaption

- Chikungunya virus developed a mutation that allows easier transmission by Aedes albopictus

Urbanization

- Urbanization of human populations

Climate change

What next?

What is needed?
- Appropriate vector
- Vertebrate host
- Suitable environmental conditions
- Susceptible population

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