HENIPAVIRUSES (NIPAH VIRUS)

AETIOLOGY

Classification of the causative agent

Henipaviruses are zoonotic, enveloped, negative-sense, single-stranded RNA viruses within the family *Paramyxoviridae*. Nipah virus (NiV) was first observed in Malaysian and Singaporean pigs in 1998-99 and was initially believed to be an atypical presentation of Japanese encephalitis.

For the purpose of voluntary reporting on non OIE-notifiable disease in wildlife, “Nipah virus” refers to **pteropid bat** infections. Information on infections of Nipah virus in **swine** must be submitted through the mandatory reports for the OIE-notifiable diseases.

Resistance to physical and chemical action

Temperature: Optimal survival at ambient temperatures (~22°C) but substrates such as palm sap increase heat resilience

pH: Stable between pH 4.0-10.0

Chemicals/Disinfectants: Inactivated by soaps, detergents, and hypochlorites

Survival: Does not persist long in the environment and is vulnerable to dessication; mildly prolonged survival time in urine and in certain fruit juices/flesh

EPIDEMIOLOGY

Hosts

- Domestic pigs (*Sus scrofa*)
- Fruit bats/flying foxes (*Pteropus* spp.)
- Humans (*Homo sapiens*)
- Domestic cats (*Felis catus*)
- Domestic dogs (*Canis familiaris*)
- Domestic hoofstock
    - Horses (*Equus ferus caballus*)

Transmission

- Ingestion of contaminated feed or undercooked meat from an infected animal
    - Many human infections are obtained from ingestion of contaminated date palm sap
    - Swine may be infected by ingesting fruit partially consumed by pteropid bats
- Inhalation of aerosols
- Contact with infectious animals or tissues
- Unlike Hendra virus, humans may be infected by NiV via a natural host or another human
- The virus circulates enzootically in natural flying fox populations

Sources

- Excretions and secretions from infected bats, especially urine and saliva
- Respiratory secretions and saliva from infected pigs
- Meat or carcasses of infected animals
- Direct exposure to infected animals or humans

Occurrence

NiV was first detected in Malaysia and Singapore in 1998-99. A different strain was identified in a 2001 outbreak in Bangladesh, where outbreaks have since occurred annually. India has also reported multiple human outbreaks of NiV. An outbreak in humans and domestic horses occurred in the Philippines in 2014.

Based upon the natural range of pteropid bats, most of Southeast Asia, China, Madagascar, Australia, and parts of Africa are considered at-risk for NiV outbreaks. Brazil and many countries within sub-Saharan Africa have detected henipavirus-specific antibodies in fruit bats. There is serologic data to suggest spillover to livestock and humans has occurred without causing overt signs of clinical illness. Henipaviruses have been unable to be isolated from African fruit bat hosts, but the genome of Ghanaian bat henipavirus (GhV) has been entirely sequenced from an infected *Eidolon helvum* bat. There is currently much need for continued investigation into African henipavirus prevalence, including NiV.

For more recent, detailed information on the occurrence of this disease worldwide, see the OIE World Animal Health Information System - Wild (WAHIS-Wild) Interface [http://www.oie.int/wahis_2/public/wahidwild.php/Index].

DIAGNOSIS

Experimental infections in Pteropid bats are sub-clinical and produce low titres of neutralising antibodies. Shedding is believed to be low-level and intermittent, and it often begins within days of infection. However, virus shedding is likely to not occur at all in most bats. Seroconversion occurs at approximately 10 days post-infection. In general, genome detection in experimental settings is low-yield which may suggest early clearance of the virus.

Clinical diagnosis

Experimentally infected fruit bats do not show signs of disease, and NiV is believed to be generally nonpathogenic in these species. Additionally, no adverse effects to bat fetuses have been observed in infected pregnant dams.

Clinical disease in pigs and humans is primarily respiratory and neurological in nature. Sporadic cases in domestic horses, goats, and sheep have resulted in similar disease and acute death. The mortality rate in humans has ranged between 40-75% by outbreak, and the severity of encephalitis corresponds with a higher mortality rate.

Lesions

- No gross or histopathologic lesions are apparent in experimentally infected fruit bats

Differential diagnoses

- Hendra virus
- Japanese encephalitis

- Bacterial meningitis

Laboratory diagnosis

Samples

For isolation of agent

- Placenta, uterine fluid
    - Fetal tissues may also be used
- Pharyngeal/oronasal swabs
- Rectal swabs
- Urine
- Tissues harvested post-mortem have failed to yield virus genome in some experimental studies

Serological tests

- Whole blood
- Serum

Procedures

Identification of the agent

- Reverse-transcriptase polymerase chain reaction (RT-PCR)
- Virus isolation
- Immunohistochemistry (IHC)
    - Cross reactivity with other henipaviruses, namely Hendra virus, is a concern
    - Some studies have shown an inability to detect NiV in tissues from inoculated animals

Serological tests

- Virus neutralisation assays
    - Considered the gold standard
    - Serum from experimentally infected bats may neutralise NiV even in the absence of detectable genome
- IgG or IgM antibody capture enzyme linked immunosorbent assay (ELISA)
- Antigen capture ELISA

For more detailed information regarding laboratory diagnostic methodologies, please refer to Chapter 3.1.14 Hendra and Nipah virus diseases in the latest edition of the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.

PREVENTION AND CONTROL

Sanitary prophylaxis

- Cover sap collection mechanisms/sites to prevent bat access and exposure to their excretions
- Boil collected date palm sap/juice before ingestion, and all fruits should be washed and peeled before eating. Any fruit with evidence of bat bites or scratches should not be ingested.
- All instruments and tools used in the harvesting and processing of date palms should be routinely cleaned and sanitised, especially before moving to a different location

Medical prophylaxis

- No vaccines are currently available for NiV
- A recombinant vesicular stomatitis virus vectored vaccine is currently in development for humans

POTENTIAL IMPACTS OF DISEASE AGENT BEYOND CLINICAL ILLNESS

Risks to public health

- Swine are considered amplifying hosts for NiV, therefore, individuals working near infected swine should be diligent in wearing personal protective equipment. The number of personnel and frequency of visits should be minimised to reduce the chances of spreading infection.
- Individuals working directly with or in close proximity to date palms and their products are at increased risk of contacting bats and their secretions. Consistent use of protective equipment for workers as well as product and instrument sanitation are recommended.
    - Maintain scrutiny over the quality of date products; evidence of contamination warrants appropriate follow-up actions (boiling, washing/peeling, or discarding the product) and consideration of preventative measures (i.e., prevention of bat access)

Risks to agriculture

- While the morbidity and mortality rates of NiV in pigs are not unusually high, outbreaks in rural communities that rely heavily on swine production have the potential to cause significant economic harm and endanger food security.
- While it is speculative at this time, there is concern NiV could be introduced and established in African bats due to the number of extant fruit bats in certain regions.

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The OIE will periodically update the OIE Technical Disease Cards. Please send relevant new references and proposed modifications to the OIE Science Department (scientific.dept@oie.int). Last updated 2020. Written by Samantha Gieger with assistance from the USGS National Wildlife Health Center.