

# ELEPHANT ENDOTHELIO TROPIC HERPESVIRUS

Aetiology Epidemiology Diagnosis Prevention and Control  
Potential Impacts of Disease Agent Beyond Clinical Illness References

## AETIOLOGY

### **Classification of the causative agent**

Elephant Endotheliotropic Herpesvirus (EEHV) is a double-stranded DNA virus that is classified in the family *Herpesviridae*, subfamily *Betaherpesvirinae*, genus *Proboscivirus*, and species *Elephantid betaherpesvirus*. EEHV causes acute, fatal haemorrhagic disease in wild and captive juvenile Asian and African elephants. If severe, EEHV can result in death within 24 hours of infection. Asian elephants are an endangered species, therefore EEHV poses a severe threat to conservation efforts. EEHV consists of eight genotypes that include EEHV1 through EEHV6, each varying in their lethality. EEHV strains exhibit some level of elephant species tropism:

- EEHV1, Asian species
- EEHV1A, Asian species
- EEHV1B, Asian species
- EEHV2, African species
- EEHV3, Asian and African species
- EEHV4, Asian species
- EEHV5, Asian species
- EEHV6, African species

### **Resistance to physical and chemical action**

Temperature:	Not yet determined
pH:	Not yet determined
Chemicals/Disinfectants:	Bleach diluted to 1:10 solution in water is commonly used to disinfect surfaces contaminated with most Herpesviruses; however, it has not been proven to inactivate EEHV.
Survival:	EEHV is easily inactivated outside the host's body (most likely due to sunlight and UV light), thus transmission of EEHV requires close contact of the hosts.

## EPIDEMIOLOGY

### **Hosts**

- Asian elephants (*Elephas maximus*)
- African elephants (*Loxodonta africana*)

### **Sources**

- To date, the natural sources and pathogenicity of EEHV remain unclear
- It is known infected elephants shed virus in trunk secretions, saliva, and other body fluids

### **Transmission**

- Direct contact with body fluids of infected elephants (saliva, shedding from skin lesions, etc.)
  - Virus transmission via semen has not been reported.
- Aerosol inhalation

- The role of indirect transmission via fomites has not been determined.

### **Occurrence**

EEHV occurs in young Asian and African elephants in North America, Europe, Africa and Asia (including India, Thailand, Myanmar and Cambodia).

**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](http://www.oie.int/wahis_2/public/wahidwild.php/Index)].**

## **DIAGNOSIS**

The incubation period of EEHV is not well characterized, however in retrospective studies, viremia has been detectable 12-72 hr. after the onset of clinical signs. EEHV primarily causes acute haemorrhagic disease, mostly in young Asian elephants, with a mortality rate of up to 85%.

### **Clinical diagnosis**

Clinical signs are predominantly nonspecific, and disease is often subclinical. Typical clinical signs include: lethargy, anorexia, mild colic, and tachycardia. There is often oedema of the head, neck, trunk, and thoracic limbs. Cyanosis of the tip of the tongue that progresses caudally, haemorrhage of the tongue, and oral ulcers are also seen. Acute skin nodules can also be seen throughout the trunk.

### **Lesions**

- Follicular lymphoid nodules
- Petechial and ecchymotic haemorrhage throughout internal organs and tissues
- Haemorrhage and oedema of submucosa and subserosa of the gastrointestinal tract
- Ulcerations of the oral cavity, larynx, and large intestine
- Lingual cyanosis
- Hepatomegaly with hepatic sinusoidal expansion
- Erosive and ulcerative dermatitis of the skin
- Subacute myocarditis

### **Differential diagnoses**

- Clostridial enterotoxaemia
- Encephalomyocarditis
- Hypovitaminosis E
- Mammalian tuberculosis (*Mycobacterium tuberculosis*)
- Rabies
- Poxvirus infection
- Salmonellosis
- Subcutaneous abscesses
- Tetanus

### **Laboratory diagnosis**

#### **Samples**

*For isolation of agent*

- Faeces
- Frozen heart, lung, spleen, liver, kidney, tongue and intestine
- Nasal mucus via trunk wash
- Saliva or oral swab

- Whole/anticoagulated blood in ethylenediamine tetra acetic acid (EDTA)-containing tubes and/or heparin (10 ml)

#### *Serological tests*

- Frozen serum samples (10–20 ml)

#### **Procedures**

##### *Identification of the agent*

- Polymerase chain reaction (PCR) – detection of viral genome may be useful when samples are unsuitable for virus isolation or antigen detection;
  - Used to confirm viremia in clinically ill elephants
  - Postmortem PCR analysis can be performed on heart, liver, tongue, intestines, and any other haemorrhagic tissue
  - Quantitative real-time PCR (qPCR) may be performed on all blood, oral swab, trunk wash, or fecal samples
- Isolation of elephant peripheral blood mononuclear cells (PBMCs)
  - Utilize blood collected in EDTA, cultured, fixed, and stained with immunofluorescent solution
- Histopathology
  - Histological staining with hematoxylin and eosin (H&E) of 4 µm-thick sections of formalin-fixed, paraffin-embedded (FFPE) tissues
  - Viral inclusion bodies in endothelial cells of the gastrointestinal tract are a hallmark of EEHV
- Loop-mediated isothermal amplification (LAMP) serves as a rapid and simple detection method for EEHV1 in blood that has been shown to amplify and detect nucleic acid efficiently and specifically under isothermal conditions

##### *Serological tests*

- Enzyme-linked immunosorbent assay (ELISA)
- Western immunoblotting using aforementioned frozen tissues
- Immunochemistry
- Immunofluorescence

## **PREVENTION AND CONTROL**

#### ***Sanitary prophylaxis***

- Isolate clinically ill elephants (if in captivity) until resolution of clinical signs
  - Calves should not be isolated from their dams unless temporarily necessary for treatment

#### ***Medical prophylaxis***

- No vaccine or formal treatment is available for EEHV
  - However, aggressive treatment with antiviral agents (famciclovir or ganciclovir) has been shown to improve clinical signs in some cases.

## **POTENTIAL IMPACTS OF DISEASE AGENT BEYOND CLINICAL ILLNESS**

#### ***Risks to public health***

- EEHV is not zoonotic and does not pose a risk to public health.

## Risks to agriculture

- Not yet determined

## REFERENCES AND OTHER INFORMATION

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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 Scientific and Technical Department ([scientific.dept@oie.int](mailto:scientific.dept@oie.int)). Last updated 2019. Written by Marie Bucko and Samantha Gieger with assistance from the USGS National Wildlife Health Center.