

ENDOTHELIO TROPIC ELEPHANT HERPESVIRUS (EEHV)

| Animal Group(s) Affected | Transmission | Clinical Signs | Severity | Treatment | Prevention and Control | Zoonotic |
|---|---|---|--|---|---|----------|
| Asian elephants, especially ages 1-8 years. Rarely, African elephants. | Direct transmission between animals via trunk secretions and saliva or other body fluids. | Subcutaneous edema of head, neck, trunk, legs. Cyanotic, swollen tongue. Lethargy, anorexia, mild colic, diarrhea. Hemorrhagic oral ulcers. Lameness. | Can be fatal in young elephants, if not – and even when – promptly treated. It may cause ulcers or vesicles in mouth and on vaginal mucosa. Milder clinical or sub-clinical forms exist. In African elephants, carrier state also exists in lymphoid lung nodules, and possibly reactivated in skin nodules. | Famciclovir orally or rectally. Supportive care. Ganciclovir has been used intravenously. | Isolate clinically ill elephants until resolution of clinical signs. Collect blood and serum for PCR test to confirm diagnosis. | No. |

Fact Sheet compiled by: Jackie Gai; updated by Lauren Howard

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Fact Sheet Reviewed by: Paul Ling, Erin Latimer, Gary Hayward

Susceptible animal groups: Infant and juvenile Asian (and very occasionally African) elephants are more likely to die from infection than older animals although there are reported cases of fatalities in elephants up to 40 years old. Adult elephants of both species may be subclinical carriers or may display a milder form of the disease with intermittent oral and vaginal/vestibular lesions.

Causative organism: Elephant Endotheliotropic Herpesviruses (EEHV) = Novel genus names Probosciviruses. Several types and multiple strains have been isolated and identified from fatal cases and clinically ill elephants.

Zoonotic potential: None known.

Distribution: Seven related species/types of EEHV have been identified in captive Asian or African elephants throughout the world. Multiple cases of the same hemorrhagic disease have been identified in wild Asian calves in Asia. Most captive and all wild elephants likely carry several EEHV types in a latent state. EEHV 1, 3/4 (test used does not distinguish between 3 and 4) and 5 detected in trunk washes of clinically normal camp elephants in India.

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| EEHV Strain | Species | Clinical Picture |
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| 1A | Asian | Hemorrhagic disease, newly reported as asymptomatic |
| 1B | Asian | Hemorrhagic disease |
| 2 | African | Hemorrhagic disease; lung nodules, skin nodules |
| 3 | Asian/African | Hemorrhagic disease; lung nodules, skin nodules |
| 4 | Asian | Hemorrhagic disease |
| 5 | Asian | Asymptomatic / hemorrhagic disease recently reported |
| 6 | African | Lung nodules |
| 7 | African | Lung nodules, skin nodules |

Incubation period: While not known definitively, presentation in clinically affected calves has occurred likely just days after primary infection. In retrospective analysis of recent clinical cases, EEHV viremia has been detectable on quantitative PCR 1 week or more prior to clinical signs. Herpesviral infections usually remain latent with sporadic subclinical reactivation (i.e., shedding in trunk washes or other secretions) throughout the lifetime of an infected elephant.

Clinical signs: Acute and potentially fatal infection may initially present with subcutaneous edema of the head, neck, trunk, and thoracic limbs. Tongue may turn blue or purple (lingual cyanosis). Lethargy, anorexia, mild colic, diarrhea, lameness or stiffness and hemorrhagic oral ulcers may occur. Once edema and lingual cyanosis appear, survival is unlikely. Obvious signs may not occur before it is too late to treat; it is imperative to take samples for diagnosis at first signs of calf being “off”.

Post mortem, gross, or histologic findings: Gross necropsy findings may include pericardial effusion with diffuse petechial hemorrhages throughout the heart, tongue, and visceral surfaces. Lingual cyanosis and hepatomegaly may also be seen. Ulcerations of the oral cavity, larynx and large intestine have been seen. Histologic findings may include extensive microhemorrhages and edema in the heart and tongue, with lymphocytic, monocytic, and neutrophilic infiltration of the myocardium. Capillary endothelial cells of the myocardium, tongue, and hepatic sinusoids may contain amphophilic to basophilic viral inclusion bodies. These herpesviral particles are usually intranuclear, and occasionally intracytoplasmic, but have not been seen outside of cells.

Diagnosis: PCR on whole blood can confirm stage of viremia in clinically ill elephants. Virus can also be detected in serum of severely affected animals. Post-mortem PCR analysis can be done on heart, liver, tongue, intestines, and any other hemorrhagic tissues. PCR on lung nodules can be performed; it is important to note that several EEHV types have been found by PCR in lung nodules of asymptomatic carrier Africans, but not known yet in asymptomatic Asians. Trunk wash PCR may demonstrate EEHV shedding and potentially indicate prior infections in asymptomatic herd mates and survivors of primary infections.

Material required for laboratory analysis: Whole blood in EDTA tube, frozen (PCR).

Frozen serum (PCR, ELISA).

Transfer all liquid samples to plastic tubes before shipping

Heart, liver, spleen, lymph nodes, intestines, skin or mucosal nodules, lung nodules, frozen (PCR).

Cell pellet from centrifuged trunk wash (real-time PCR). Fresh, unfrozen samples of serum, positive trunk

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| washes and lesions needed for attempts at cell culture. |
| Relevant diagnostic laboratories Smithsonian, National Zoological Park Department of Pathology Attn: Erin Latimer/Laura Richman 3001 Connecticut Ave NW Washington, DC 20008 (202) 633-4252 (703) 855-9611 latimere@si.edu *Please call or/email before sending samples* |
| Baylor College of Medicine, Department of Virology and Microbiology Performs quantitative real time PCR on whole blood or trunk wash samples. For details, contact: Dr. Paul Ling: pling@bcm.edu Lab phone: (713) 798 8475 Cell phone: (281) 460 1696 |
| Treatment: Famciclovir (8-15 mg/kg orally or rectally TID) for Asian elephants has been reported (Brock <i>et al</i> 2012). Ganciclovir has also been used but must be given intravenously. |
| Prevention and control: Isolate clinically ill animals as long as they are showing clinical signs. Bank frozen whole blood, serum and trunk wash on all clinical elephants and herd mates for potential future study. Once prevalence is known from ongoing investigations, informed decisions can be made in regards to movement of individual elephants between populations. |
| Suggested disinfectant for housing facilities: Bleach diluted to 1:10 solution in water is often used to disinfect surfaces contaminated with most Herpesviruses, although it has not been proven to inactivate EEHV. |
| Notification: No special notification process required. |
| Measures required under the Animal Disease Surveillance Plan: Currently none. |
| Measures required for introducing animals to infected animal: Keep clinically ill animals isolated until resolution of clinical signs. Calves should not be isolated from their dams unless necessary to facilitate treatment. |
| Conditions for restoring disease-free status after an outbreak: No cure is available for latent herpesviral infection. It is assumed to be endemic in both Asians and Africans. |
| Experts who may be consulted: Website with information on detection, treatment, etc: www.eehvinfo.com Erin Latimer/Laura Richman Smithsonian's National Zoological Department of Pathology 3001 Connecticut Ave. NW Washington, DC 20008 202-633-4252 (703) 855-9611 latimere@si.edu Michele Miller DVM, PhD (treatment advice) |

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