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Standards of Care for Elephant Calves for EEHV-Preparedness

Elephant endotheliotropic herpesvirus (EEHV) disease is the single greatest cause of death of Asian elephants (*Elephas maximus*) born in North America since 1980.⁵ Elephant endotheliotropic herpesvirus has also caused clinical disease in African elephants (*Loxodonta africana*),³ though much about its epidemiology in this species remains unknown. Disease associated with EEHV infection is seen most commonly in elephant calves between one and eight years of age, though older elephants have also experienced EEHV related illness and death.⁷ The onset of EEHV-associated disease, or EEHV Hemorrhagic Disease (EEHV HD) is sudden and death can occur within hours after the first clinical signs are observed.¹¹

Standard confirmatory diagnosis of EEHV-associated disease involves detection of high levels of EEHV DNA in blood (viremia). Because the fatality rate is at least 80% in untreated elephants with clinically evident disease, early detection and treatment provides the best chances of survival. Research has shown that elephant calves may demonstrate low detectable EEHV viral DNA in the blood up to ten days before they show outward clinical signs of illness from EEHV-associated disease.⁹ This low-level viremia precedes disease and is indistinguishable from transient, episodic viremia that has been seen in some calves without development of clinical disease. Early detection and ability to distinguish between benign episodic viremia and early disease are critical for timely antiherpesvirus drug intervention and other appropriate health care responses.

Clinical abnormalities detected in conjunction with severe and often fatal EEHV-associated disease include (but are not limited to) the following:^{1,7,11}

Early Findings

1. Abnormalities in the number, distribution, and appearance of white blood cells, particularly monocytopenia or monocytosis.
2. Decrease in number of platelets (thrombocytopenia) and changes in coagulation markers.
3. Elevations in acute phase proteins (serum amyloid AA and haptoglobin).⁸
4. Any deviation from the calf's normal parameters or behaviors, including eating, drinking, sleeping patterns, activity level, response to training.

Later Findings

5. Retropharyngeal and cervical lymph node enlargement (detected by palpation and ultrasonography)
6. Lameness, stiffness, or lethargy.
7. Changes in the oral mucosa including ulcers, cyanosis or hyperemia.
8. Edema (fluid accumulation) in the head, limbs, and internal organs, including the lungs.
9. Elevation of respiratory rate and heart rate.

Though much remains to be learned about the pathogenesis and epidemiology of EEHV infection and EEHV-associated disease, it is evident from the currently available data that regular monitoring of elephant calves between one and eight years old for the presence of EEHV viremia, blood cell abnormalities, and clinical abnormalities will hasten a diagnosis of potentially fatal hemorrhagic disease, and facilitate rapid and timely treatment.

Based on these observations, the EEHV Advisory Group recommends the following guidelines for EEHV preparedness and consistent institutional vigilance over elephant calf health.

Institutional Preparedness

1. An institution that is actively breeding Asian or African elephants should have documentation of an EEHV Preparedness Protocol or institutional discussion about EEHV monitoring, diagnosis, treatment, and post-mortem processing of suspected EEHV cases.⁴
2. An institution that houses Asian elephant calves between one and eight years of age should:
 - a. Have on zoo grounds enough doses of an antiviral medication (famciclovir, acyclovir and ganciclovir have all been used) to treat all at-risk calves for a minimum of 3 days.²
 - b. Arrange for weekly screening of calf whole blood for EEHV via cPCR or qPCR. A list of labs that can perform EEHV PCR is available on the www.eehvinfo.org website.
 - c. Have in place protocols for standing sedation of calves to facilitate testing and treatment. The institution should be capable of and willing to perform sedation if indicated.
 - d. Have in place protocols for plasma collection, storage and administration, and for cross-matching.
 - e. Perform EEHV Preparedness Drills and update their EEHV protocol on a regular basis.
 - f. Commit the personnel and financial resources necessary for regular monitoring of calves for EEHV (shipping and testing fees) and to allow for treatment of calves with EEHV HD (antiviral costs).

Calf Training for EEHV Monitoring

1. Voluntary blood collection:
 - a. A training program for blood collection on elephant calves should be initiated by the time the calf is six months old.
 - b. Consistent and regular blood collection should be performed on all elephant calves by one year of age, and should continue until calves reach at least eight years old.
2. Elephant calves should be trained to allow the following non-invasive examinations by one year of age (and behaviors continue until at least eight years of age):^{10,11}
 - a. Stand on scale for accurate body weight
 - b. Acclimate to the presence of institutional veterinarian(s)
 - c. Oral exam
 - d. Ocular exam with a flashlight
 - e. Evaluation of body temperature (via fecal bolus, microchip, or thermal imaging)

- f. Non-invasive blood pressure measurement at base of tail
 - g. Desensitization to allow placement of a stethoscope or ultrasound probe over thorax and abdomen, or placement of ultrasound probe on neck to monitor lymph nodes
3. Trunk wash collection:
Elephant calves should be trained for trunk wash collection by one year of age.⁶

Calf Training for EEHV Treatment

1. Calves should be trained to accept the following by one year of age (and behaviors continue until at least eight years of age):
 - a. Separation from dam.
 - b. Be placed on leg restraints.
 - c. Administration of medications orally or rectally.
 - d. Administration of fluids rectally.
 - e. Administration of subcutaneous or intramuscular injections.
 - f. Desensitization to allow IV injections and/or IV catheter placement
2. Staff should be familiar with the logistical requirements of standing sedation and should be prepared to take this step if needed to allow for sample collection or treatment.

These recommendations were reviewed and updated by group consensus on July 23, 2016 during the 2nd Biannual meeting of the EEHV Advisory Group and invited specialists:

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