**EEHV Advisory Group Meeting**

**7/23/16 Atlanta, GA**

**Meeting Report**

Regional Updates

**North America – Asian Elephants**

Additional At-Risk Calf Monitoring: Ringling CEC has purchased 2 TEG machines, they are monitoring 6 at-risk elephants weekly with qPCR, CBC, and TEG results, in addition to qPCR monitoring with the National EEHV Laboratory. Initially will be building up individual “normal” values for these elephants, with hope to detect early changes in TEG in the future. (Information provided by Dr. Dennis Schmitt)

Post Transfer Monitoring: Ft. Worth Zoo evaluated EEHV viremia, trunk wash shedding, and cortisol in elephants after new bull brought in. Monitored for 3 weeks before the move and for 4 weeks after move, no significantly different shedding and no significant elevations in cortisol. Did not monitor for longer than 7 weeks due to cost constraints of testing. (Information provided by Dr. Carlos Sanchez)

New Platelet Evaluation Techniques: Oklahoma City Zoo has been evaluating the use of plateletcrit, which is the percentage of blood volume filled by platelets. It is an assessment of circulating platelet mass and is sometimes reported with CBCs, but has not been clinically evaluated in elephants. They looked at plateletcrit vs. total platelet number (automated) during viremia and found that plateletcrit had more discrete changes. Small changes in plateletcrit may be an early sign that the platelets are being taxed by viremia, and may be an earlier indicator than drop in total platelet count. Normal values for individuals should be established to facilitate interpretation of results. (Information provided by Dr. Gretchen Cole)

Routine Monitoring of Calves: Oregon Zoo and Saint Louis Zoo have both detected somewhat low level, subclinical viremias from different EEHVs (EEHV4, EEHV5, EEHV1A) in elephant calves they are monitoring regularly. Most calves were clinically normal during viremia, though one developed a significant EEHV5 viremia and had vague mild clinical signs that resolved within a few days. (Information provided by Dr. Tim Storms and Dr. Chris Hanley)

**North America – African elephants**

Pittsburgh Zoo has 11 African elephants, with two young elephants (8 & 10 years old) and a calf on the way. Dr. Alicia Hahn is working with Erin Latimer of the NEHL and Virginia Pearson to develop an African elephant herd monitoring strategy.

The Maryland Zoo continues to monitor Samson (8 years old) every two weeks for EEHV since surviving EEHV3B infection over 3 years ago. (Information provided by Dr. Christy Rettenmund)

**Asia**

Wildlife Veterinarian Arun Zachariah, DVM, from Kerala Veterinary and Animal Sciences University and Kerala Wildlife Service, Weyanad, India, was invited to attend the second annual EEHV Advisory Meeting at the Hyatt regency Hotel, in Atlanta, Georgia on July 22cd to July 24th 2016. His role at the meeting was to report to the Advisory Board about the First Annual meeting of the EEHV Asia Working Group held in Singapore in Nov 2015, as well as to give an update about the status of EEHV disease cases, including efforts at detection and diagnosis in Range Countries. Zachariah had been the lead author on the first published report in the Journal of Wildlife Diseases in 2013 about confirming the existence of fatal EEHV1-associated hemorrhagic disease in nine young Asian elephants in Southern India, together with coauthors Erin Latimer at the NEHL diagnostic Laboratory at National Zoological Park (Washington DC) and Gary Hayward’s Herpesvirus Genomics group at Johns Hopkins University (Baltimore, MD). The Asian branch had met to begin to cooperate and coordinate activities across all potentially affected Asian countries, especially with regard to pathological sample collection, testing procedures and treatment options and has completed plans for a published brochure “Guidelines for Management of Elephant Endotheliotropic Herpesvirus (EEHV) in Asia” compiled by Sonja Luz (Singapore Zoo) and Lauren Howard (Houston/San Diego Zoos).

Arun Zachariah’s laboratory in Weyanad, India was established in 2008 together with NEHL and the IEF, and is one of the designated laboratories that offers testing of necropsy samples, wherever it is possible for them to be transported with appropriate permits between countries. Zachariah had also set the standards for others to follow by travelling to both Sumatra and Myanmar himself to carry out DNA PCR tests there and arranging for local PCR DNA sequencing analysis of the resulting PCR products. Overall, Zachariah has now confirmed a total of 14 cases in India plus two in Sumatra and three in Myanmar. Others had also previously published on five EEHV1 or EEHV4-positive cases in Thailand and three in Laos, with a promised major report in progress by Supaphen Sripipoon and Chatchote Thitaram on up to 12 more DNA confirmed cases in Thailand, which like Zachariah’s cases had been properly sequenced confirmed at multiple PCR gene loci, including the characteristic U51/vGPCR1 locus used for subtype/strain determination as recommended by the NEHL/Hopkins group, that allows for epidemiological comparison with the nearly 50 thoroughly evaluated lethal and surviving EEHV1 strains identified from cases in North America and Europe.

Efforts are now being made to track down and document additional cases across Asia (from Nepal, Sumatra and Borneo). Importantly, whilst virtually all of the analyzed cases in Thailand and Myanmar had been from captive and logging camp elephants, Zachariah emphasized that most of his cases in India, as well as those in Sumatra, were from either wild-born orphans being raised in captivity or from true free-ranging wild elephants living in forest reserves. Part of Zachariah’s time in Atlanta was also spent in consultation with Latimer and Hayward in adding updated improved diagnostic tests and on the planning for a second publication including the new cases from India, Sumatra and Myanmar.

**Europe**

Impact of EEHV in Europe: There have been 27 fatal EEHV-HD cases in Europe. Of 238 Asian calves born since 1988, 43 have died (18% mortality rate overall). Of the 43 that have died, 26 died from EEHV-HD (60% of calf deaths). There were 7 cases of fatal EEHV in 2015 and 2016. (Information below provided by Dr. Willem Schaftenaar)

EEHV-HD fatal cases in Europe since 1988 (*Elephas maximus* only):

**Fatal cases in Europe 27**

EEHV 1A 18

EEHV 1B 4

EEHV 1A+B 1

Unknown EEHV 1 2

EEHV 5 1

EEHV 1A + EEHV 4 1

Breeding balance 1995 – 2016:

Total number of calves born: 238

Total number calf deaths: 43

Mortality rate: 18%

**EEHV-HD fatal cases: 26 (60% of deaths, 11% of all calves born)**

Recent peracute EEHV-HD cases:

* Chester
* Amsterdam
* Ostrava
* Estepona

An EEHV-treatment document for European Elephant TAG was approved by (4) vet advisors and launched on the European TAG website (and on our eehvinfo.org site).

The main obstacles in Europe to address EEHV-HD cases are:

* Training of young calves for monitoring (blood sampling)
* Training of young calves and mothers for emergency treatment
* Elephants, keepers and zoo vets are not prepared for emergency treatment

Intention to create European EEHV-Research Consortium

EEHV-TAG coordinator: Tim Bouts

EEHV-TAG Advisor: Willem Schaftenaar

The main (future) research issues for the European EEHV Research Consortium are listed below. One strategy mentioned was to find a European Union Grant to help fund a united research proposal.

* Virus culture
* Vaccine development
* Immunological mechanisms (T-cell responses, cytokins)
* IHC
* Antibody tests
* Epidemiology: molecular, excretion, serotyping
* Genetic factors
* Management related factors

The Copenhagen Zoo and IZW (Prof. Alex Greenwood) are working together to look at MHC antigens in elephants and how they may relate to EEHV epidemiology (Information provided by Dr. Kathryn Perrin)

IZW (Dr. Thomas Hildebrandt) is working to better understand risk factors for EEHV fatalities and are evaluating nutritional components and composition of milk. (Information provided by Dr. Thomas Hildebrandt)

Chester Zoo is going to fund a research/PhD position to focus on EEHV. (Information provided by Dr. Javier Lopez)

EEHV in African Elephants

Brief list of EEHV incidents in African elephants:

* EEHV2 fatality at Oakland Zoo in 1996
* EEHV6 survivor at Riddles Sanctuary (Ms. Betts)
* EEHV3B survivor (with treatment) at Maryland Zoo (Samson)
* EEHV6 fatality of an African elephant in a Thailand Zoo
* Asymptomatic African elephants with lung nodules found incidentally on necropsy
  + Multiple EEHVs identified in lung nodules
* Skin nodules seen in 1-5% of juvenile elephants seen in Africa, mostly on head and trunk
* Currently we do not have enough data to make strong recommendations about routine monitoring of African elephant calves or African elephant herds in North America.
* Virginia Pearson has had a lot of success with PCR of saliva swabs, and has not evaluated nearly as many trunk washes. We are unsure at this time if this due to inherent differences in EEHV biology between African and Asian elephants, or if this is just a result of sampling bias? This will be investigated more thoroughly by Dr. Alicia Hahn and Virginia Pearson.
* African Elephant EEHV Working Group to include: Dr. Alicia Hahn, Dr. Christy Rettenmund, and Dr. Lauren Howard. Dr. Gary Hayward and Virginia Pearson will be very valuable resources for us.

Guidelines for Monitoring Elephants During Transfer

One area of EEHV that we have not made much headway on is how to handle elephant moves between institutions that have at-risk calves. One of the anecdotal risk factors cited often in EEHV-HD fatalities is a recent (within 6 months) move or change in herd structure. One way to learn more about what happens when new elephant(s) join a herd is to screen for EEHV shedding via PCR both before the move (as baselines for both institutions) and after the move, ideally up to several months post transfer. Additional testing that may prove insightful would be whole blood EEHV PCR, CBC and chemistry values, and cortisol levels in blood, feces or urine.It is important to note that this information, while being exceptionally valuable to improving our understanding of EEHV epidemiology and shedding, is not appropriate for evaluating the risk involved in moving elephants, **and can’t dictate if an elephant should or shouldn’t be moved. It is research/epidemiologic only.**

The EEHV Advisory Group could best serve the elephant community by developed bulleted guidelines for monitoring/testing elephants before and after a transfer, including how long to collect samples, how frequently to collect samples, what samples to collect, and how to store them if analysis immediately is not an option. **Dr. Carlos Sanchez** has offered to provide the first draft of this document, which will be vetted by the EEHV Advisory group before being posted on [www.eehvinfo.org](http://www.eehvinfo.org).

Website [www.eehvinfo.org](http://www.eehvinfo.org) Update

Thanks to the Fort Worth Zoo, we were able to hire a professional website designer, who moved the eehvinfo.org website to a new host and reorganized the content.

>There is a new “Meetings” section with links to previous EEHV meetings and their proceedings, along with information about upcoming meetings.

>Another new section has pictures of survivors of EEHV HD.

>In response to requests from attendees at the Advisory Group meeting, we are instituting the ability to set your own password for the “Professional Content” area.

>The “Publications” section has been updated with many new EEHV peer-reviewed papers**, including 17 new papers published in the last 18 months**.

>The EEHV background information is the last section to be reorganized and will be updated soon.

>Previous supporters of the website include the National Zoo, Oregon Zoo, and the International Elephant Foundation.

EEHV Research Priority List

During the lunch break, each meeting attendee was given up to three votes to identify the areas of EEHV research they thought were the most important to put time and resources into. The voting results are listed below (# of votes in parenthesis)

1. Virus Culture (16)
2. Antiviral Efficacy (12)
3. Pathogenesis, pathophysiology of hemorrhagic disease (12)
4. Vaccine Development (6)
5. Risk Factors Associated with EEHV HD (4)
6. Elephant Host Immune Response; Adaptive (cytokines, T cells, antibodies) (4)
7. Antibody Test (3)
8. Hemostatic response; Clotting, platelets, etc (3)
9. African elephant epidemiology (2)
10. EEHV Shedding (origin of shedding, saliva vs trunk wash, fetal fluids) (2)
11. Early morphological changes to detect disease (lymph nodes) (2)
12. Elephant Host Immune Response: Innate (cytokines, host defenses, acute phase proteins) (1)
13. Immunohistochemistry (1)
14. Genetics related to EEHV (Elephant genetics) and viral evolution (1)
15. Wild Asian elephant surveys (1)
16. Aciclovir PK in Asian elephants (1)
17. Famciclovir PK Study in Africans (0)
18. Ganciclovir PK in Asian elephants (0)

Regional EEHV Advisory Groups

Due to increased interest from our European and Asian colleagues, regional EEHV Advisory Groups will be formed in Europe and Southeast Asian. The Europeans are starting an EEHV Research Consortium, which will most likely be able to act as a “European EEHV Advisory Group”. The formation of the Asian EEHV Advisory Group and its relationship to the Thai-EEHV WG will be on the agenda of the 2nd EEHV Asia Strategy meeting on Nov 19, 2016 in Singapore.

EEHV Advisory Group Meeting Attendees

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| --- | --- | --- |
| Noha | Abou-Madi | Cornell University College of Vet Medicine |
| Kay | Backues | The Tulsa Zoo |
| Sara | Chapman | Zoo & Wildlife Vet |
| Gretchen | Cole | The Oklahoma City Zoo |
| Edmund | Flach | Zoological Society of London |
| Alicia | Hahn | Pittsburg Zoo |
| Chris | Hanley | Saint Louis Zoo |
| Gary | Hayward | Johns Hopkins University |
| Kelly | Helmick | Woodland Park Zoo |
| Thomas | Hildebrandt | IZW |
| Daryl | Hoffman | Houston Zoo |
| Lauren | Howard | Houston Zoo |
| Ramiro | Isaza | University of Florida College of Vet Medicine |
| Kari | Johnson | Have Trunk Will Travel |
| Jaime | Landolfi | University of Illinois Zoological Pathology Program |
| Erin | Latimer | Smithsonian Institution |
| Paul | Ling | Baylor College of Medicine |
| Javier | Lopez | Chester Zoo |
| Debbie | Olson | International Elephant Foundation |
| Kathryn | Perrin | Copenhagen Zoo |
| Christy | Rettenmund | Maryland Zoo |
| Sam | Rivera | Zoo Atlanta |
| Victor | Rutten | Utrecht University & University of Pretoria |
| Carlos | Sanchez | Fort Worth Zoo |
| Willem | Schaftenaar | Rotterdam Zoo, Netherlands |
| Dennis | Schmitt | Feld Entertainment |
| Hanspeter | Steinmetz | EAZWV, Walter Zoo |
| Mark | Stidworthy | International Zoo Veterinary Group |
| Tim | Storms | Oregon Zoo |
| Linda | Van Sonsbeek | Rotterdam Zoo, the Netherlands |
| Arun | Zachariah | Kerala Veterinary and Animal Sciences University |