

EPIZOOTIC HAEMORRHAGIC DISEASE

Aetiology Epidemiology Diagnosis Prevention and Control References

AETIOLOGY

Classification of the causative agent

Virus family Reoviridae, genus *Orbivirus*, 8 or more serotypes

Ibaraki virus is a member of the EHDV serogroup (serotype 2).
EHDV shows immunological cross reactivity with the bluetongue virus group

Resistance to physical and chemical action (adapted from Bluetongue virus)

Temperature:	Extremely unstable at high temperatures. Inactivated by 50°C/3 hours; 60°C/15 minutes or 121°C /15 minutes
pH:	Sensitive to pH <6.0 and >8.0
Chemicals/Disinfectants:	Non-enveloped virus and thus relatively resistant to lipid solvents like ether and chloroform. Readily inactivated by β-propiolactone, 2% w/v glutaraldehyde, acids, alkalis (2% w/v sodium hydroxide), 2-3% w/v sodium hypochlorite, iodophores and phenolic compounds
Survival:	Very stable in blood and tissue specimens at 20°C, 4°C, and -70°C, but not at -20°C. Resistant to ultraviolet and gamma irradiation due to its double-stranded RNA genome

EPIDEMIOLOGY

- EHD can infect most wild and domestic ruminants
- Historically EHD is a disease of wild ruminants, particularly white-tailed deer in North America, and rarely a clinical disease of cattle
- A notable exception is Ibaraki virus, which caused an extensive outbreak of disease in cattle in Japan in 1959, and continues to cause cattle disease in the Far East
- Recently EHD has become an emerging disease in cattle, and was added to OIE list of notifiable diseases in May 2008, following outbreaks in 4 Mediterranean countries
- Morbidity and mortality may be as high as 90% in white tailed deer; however severity varies between years and geographic locations

Hosts

- White-tailed deer mainly, with mule deer and pronghorn affected to a lesser extent
- Other wild ruminants, like black-tailed deer, red deer, wapiti, fallow deer, roe deer, elk, moose, and bighorn sheep may seroconvert
- Until recently, only rare outbreaks were reported in cattle, although infection is common and they may serve as temporary reservoir hosts. True persistent infection of ruminants does not occur
- Ibaraki disease is seen in cattle
- Sheep can be infected experimentally but rarely develop clinical signs, and goats do not seem to be susceptible to infection

Transmission

- Virus is transmitted by biological vectors, usually biting midges of the genus *Culicoides*, after an external extrinsic period of 10–14 days
- In temperate regions infection is most common in the late summer and autumn during peak vector population, while infection occurs throughout the year in tropical regions

- As in bluetongue infection, viraemia can be prolonged beyond 50 days, despite the presence of neutralising antibody, due to an intimate association between virus and erythrocytes. Infected deer can be viremic for up to 2 months

Sources of virus

- Blood of viraemic animals
- Infection in ruminants is not contagious – biological vectors (*Culicoides* sp.) are required
- As the virus infects endothelium, all tissues of the body may be affected

Occurrence

EHDV in cattle has been isolated throughout the world in North America, Australia, Africa, Asia, and the Mediterranean. Ibaraki disease has been reported from Japan, Korea, and Taiwan.

For more recent, detailed information on the occurrence of this disease worldwide, see the OIE World Animal Health Information Database (WAHID) Interface [<http://www.oie.int/wahis/public.php?page=home>] or refer to the latest issues of the World Animal Health and the OIE *Bulletin*.

DIAGNOSIS

Incubation period is 2–10 days

Clinical diagnosis

The clinical signs of EHD manifest as haemorrhagic disease in deer, but domestic ruminants may be subclinically infected.

- Acute EHD in deer: Fever, weakness, inappetance, excessive salivation, facial oedema, hyperaemia of the conjunctivae and mucous membranes of the oral cavity, coronitis stomatitis, and excessive salivation
- In prolonged cases, oral ulcers on the dental pad, hard palate, and tongue may occur. Excessive bleeding occurs in fulminant disease: bloody diarrhoea, haematuria, dehydration, and death
- Acute outbreaks in cattle (similar to bluetongue): fever, anorexia, reduced milk, swollen conjunctivae, redness and scaling of the nose and lips, nasal and ocular discharge, stomatitis, salivation, lameness, swelling of the tongue, oral/nasal erosions, and dyspnoea
- Ibaraki disease in cattle is characterised by fever, anorexia and difficulty swallowing
- Oedema, haemorrhages, erosions, and ulcerations may be seen in the mouth, on the lips, and around the coronets; the animals may be stiff and lame
- Abortions and stillbirths have also been reported in some epidemics. Some affected cattle die (up to 10%)

Lesions

EHD in deer:

- Peracute form: Severe oedema of the head, neck, tongue, conjunctiva, and lungs
- Acute form: widespread haemorrhages and oedema in the mucous membranes, skin and viscera, especially heart and gastrointestinal tract (GIT)
- Erosions may be found in the mouth, rumen and omasum, and necrosis in the hard palate, tongue, dental pads, oesophagus, larynx, rumen and abomasum
- Chronic form: growth rings on the hooves or sloughing of the hoof wall, and erosions, ulcers or scars in the rumen

Ibaraki disease in cattle:

- Degeneration of the striated muscles in the oesophagus, larynx, pharynx, tongue, and skeletal muscles with secondary aspiration pneumonia, dehydration and emaciation

- Marked oedema and haemorrhages in the mouth, lips, abomasum, and coronets may be observed. Erosions or ulcerations may also be present

Differential diagnosis

- Deer: indistinguishable from bluetongue, foot and mouth disease
- Cattle: bluetongue, bovine virus diarrhoea, foot and mouth disease, infectious bovine rhinotracheitis, vesicular stomatitis, malignant catarrhal fever, and bovine ephemeral fever

Laboratory diagnosis

Samples

Virus isolation and detection

- Whole blood in EDTA and/or heparin
- Spleen
- Lungs
- Lymph nodes
- Liver

Serological tests

- Paired serum samples (3–5 ml each)

Procedures

Identification of the agent

- Virus isolation: inoculation of a variety of cell cultures, especially *Aedes albopictus* cells, also CPAE (cattle pulmonary artery endothelial cells) and BHK-21 (baby hamster kidney cells). Unlike BTV, embryonated chicken eggs are not sensitive for EHDV isolation
- Viral detection: reverse transcriptase polymerase chain reaction (RT-PCR): positive test results may be difficult to interpret – EHDV nucleic acid may persist in blood of infected ruminants much longer than infectious virus
- Other molecular tests: dot blot and *in-situ* hybridisation
- Viral RNA may be found in deer tissues for up to 160 days post infection

Serological tests

- Agar gel immunodiffusion test (group specific)
- Competitive ELISA (group specific)
- Serum neutralisation assay (serotype specific)

PREVENTION AND CONTROL

- Other than Ibaraki in cattle, treatment and control is limited for EHDV

Sanitary prophylaxis

- Control *Culicoides* vectors with insecticides/larvicides, insect repellents on susceptible ruminants, and management of *Culicoides* breeding areas

Medical prophylaxis

- No vaccine is commercially available for EHD viruses, however, a live attenuated Ibaraki disease vaccine is used in Japan

- EHDV vaccines could be produced but would need to be multivalent as humoral immunity is serotype specific

For more detailed information regarding safe international trade in terrestrial animals and their products, please refer to the latest edition of the *Terrestrial Animal Health Code*.

REFERENCES AND OTHER INFORMATION

- Brown C. & Torres A., Eds. (2008). - USAHA Foreign Animal Diseases, Seventh Edition. Committee of Foreign and Emerging Diseases of the US Animal Health Association. Boca Publications Group, Inc.
- Coetzer J.A.W. & Tustin R.C. Eds. (2004). - Infectious Diseases of Livestock, 2nd Edition. Oxford University Press.
- Fauquet C., Fauquet M. & Mayo M.A. (2005). - Virus Taxonomy: VIII Report of the International Committee on Taxonomy of Viruses. Academic Press.
- Kahn C.M., Ed. (2005). - Merck Veterinary Manual. Merck & Co. Inc. and Merial Ltd.
- Spickler A.R. & Roth J.A. Iowa State University, College of Veterinary Medicine - <http://www.cfsph.iastate.edu/DiseaseInfo/factsheets.htm>
- World Organisation for Animal Health (2009). - Terrestrial Animal Health Code. OIE, Paris.
- World Organisation for Animal Health (2008). - Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. OIE, Paris.

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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). Last updated October 2009.