BLUETONGUE

Aetiology Epidemiology Diagnosis Prevention and Control References

AETIOLOGY

Classification of the causative agent

Virus family Reoviridae, genus *Orbivirus* with 20 recognised species in the genus. The bluetongue virus (BTV) species contain 24 recognised serotypes and are related to the viruses in the epizootic hemorrhagic disease (EHD) serogroup.

Resistance to physical and chemical action

Temperature:	Inactivated by 50°C/3 hours; 60°C/15 minutes.
pH:	Sensitive to pH <6.0 and >8.0.
Chemicals/Disinfectants:	Inactivated by ß-propiolactone; iodophores and phenolic compounds.
Survival:	Very stable in the presence of protein (e.g. has survived for years in blood stored at 20°C).

EPIDEMIOLOGY

- Non-contagious by casual contact
- Some midges of the genus *Culicoides* (insect host) transmit BTV among susceptible ruminants; these insect hosts having become infected by feeding on viraemic animals (the vertebrate host)
  - replication period in the insect's salivary gland of 6–8 days
  - infected midges infective for life
- Midges are the only significant natural transmitters of BTV; thus distribution and prevalence of the disease is governed by ecological factors (i.e. high rainfall, temperature, humidity and soil characteristics)
  - in many parts of the world infection has a seasonal occurrence
- BTV does not establish persistent infections in ruminants thus survival of the agent in the environment is associated with insect factors
- Morbidity in sheep can reach 100% with mortality between 30 and 70% in more susceptible breeds; mortality in wild deer and antelopes can reach 90%
  - BTV serotype 8 in Europe saw higher numbers of cattle affected however mortality remained below 1%

Hosts

- BTV vertebrate hosts include domestic and wild ruminants; sheep, goats, cattle, buffaloes, deer, most species of African antelope and other Artiodactyla such as camels
  - the roll of non-ruminant species in the disease in the wild is not known
  - variation in sheep breed susceptibility
- Cattle, goats, dromedaries, wild ruminants: generally inapparent infection

Transmission

- Biological vectors: *Culicoides* spp.

Sources of virus

- Infected *Culicoides*
- Blood
- Semen

Occurrence

Globally the distribution of BTV is directly associated with the presence of competent vectors and their habitats (episystems). BTV activity can be found on all continents except Antarctica; though different serotypes and strains cause markedly variable disease.

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 usually 5–10 days. Subclinically infected cattle can become viraemic 4 days post-infection.

Clinical diagnosis

Disease outcome of infection ranges from inapparent, in the vast majority of infected animals, to fatal, in a proportion of infected sheep, goats, deer and some wild ruminants. As with many diseases, severity will depend on factors related to agent, host, and environment.

Acute form (sheep and some species of deer)

- Pyrexia up to 42°C, excessive salivation, depression, dyspnoea and panting
- Initially clear nasal discharge becomes mucopurulent and upon drying may form a crust around the nares
- Hyperaemia and congestion of the muzzle, lips, face, eyelids and ears; leading to oedema
- Ulceration and necrosis of the mucosae of the mouth
- Tongue may become hyperaemic and oedematous; later cyanotic and protrude from the mouth
- Extension of hyperaemia to coronary band of the hoof, the groin, axilla and perineum; lameness due to coronitis or pododermatitis and myositis
- Torticolis in severe cases
- Abortion or birth of malformed lambs
- Complications of pneumonia
- Emaciation
- Either death within 8–10 days or long recovery with alopecia, sterility and growth delay

Inapparent infection

- Frequent in cattle and other species for certain serotypes

Lesions

- Congestion, oedema, haemorrhages and ulcerations of digestive and respiratory mucosae (mouth, oesophagus, stomach, intestine, pituitary mucosa, tracheal mucosa)
- Severe bilateral broncholobular pneumonia (when complications occur); in fatal cases, lungs may show interalveolar hyperaemia, severe alveolar oedema and the bronchial tree may be filled with froth
- Thoracic cavity and pericardial sac may contain large quantities of plasma-like fluid; distinctive haemorrhages found at base of pulmonary artery
- Congestion of hoof laminae and coronary band
- Hypertrophy of lymph nodes and splenomegaly

Differential diagnosis

- Contagious ecthyma
- Foot and mouth disease
- Vesicular stomatitis
- Malignant catarrhal fever
- Bovine virus diarrhoea
- Infectious bovine rhinotracheitis
- Parainfluenza-3 infection
- Sheep pox

- Photosensitisation
- Pneumonia
- Polyarthritis, footrot, foot abscesses
- Plant poisonings (photosensitisation)
- Peste des petits ruminants
- Coenurosis (*Oestrus ovis* infestation)
- Epizootic haemorrhagic disease of deer

Laboratory diagnosis

Samples

- Living animals: blood in heparin
- Freshly dead animals: spleen, liver, red bone marrow, heart blood, lymph nodes
- Aborted and congenitally infected newborn animals: pre-colostrum serum plus same samples as for freshly dead animals
- All samples have to be preserved at 4°C, and **not frozen**
- Paired sample sera

Procedures

Isolation of the agent

- Inoculation of sheep
- Intravascular inoculation in 10–12-day-old embryonated chicken eggs

Identification of the agent (a prescribed test for international trade)

- Virus isolation
    - performed in: embryonated chicken eggs, cell culture or sheep
    - same diagnostic procedures are used for domestic and wild ruminants
- Immunological methods
    - Serogrouping of viruses by
        - Immunofluorescence
        - Antigen capture enzyme-linked immunosorbent assay
        - Immunospot test
    - Serotyping by virus neutralisation via
        - Plaque reduction
        - Plaque inhibition
        - Microtitre neutralisation
        - Fluorescence inhibition test
- Reverse-transcription polymerase chain reaction (a prescribed test for international trade)
- Real-time reverse-transcription polymerase chain reaction tests

Serological tests

- Complement fixation
    - largely replaced by the AGID test
- Agar gel immunodiffusion (an alternative test for international trade)
    - simple to perform and the antigen used in the assay is relatively easy to generate
    - one of the standard testing procedure for international movement of ruminants
    - one of the disadvantages of the AGID used for BT is its lack of specificity in that it can detect antibodies to other Orbiviruses, particularly those in the EHD serogroup
    - AGID positive sera may have to be retested using a BT serogroup-specific assay
    - lack of specificity and the subjectivity exercised in reading the results have encouraged the development of ELISA-based procedures for the specific detection of anti-BTV antibodies
- Competitive enzyme-linked immunosorbent assay (a prescribed test for international trade)
    - BT competitive or blocking ELISA was developed to measure BTV-specific antibody without detecting cross-reacting antibody to other Orbiviruses
    - specificity is the result of using one of a number of BT serogroup-reactive MAbs

- Indirect ELISA
    - shown to be reliable and useful for surveillance purposes for bulk milk samples

For more detailed information regarding laboratory diagnostic methodologies, please refer to Chapter 2.1.3 Bluetongue in the latest edition of the OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* under the heading "Diagnostic Techniques".

PREVENTION AND CONTROL

Sanitary prophylaxis

- No efficient treatment
- Disease-free areas:
    - animal movement control, quarantine and serological survey
    - vector control, especially in aircraft
- Infected areas:
    - vector control

Medical prophylaxis

- Both live attenuated and killed BTV vaccines are currently available; attenuated vaccines are seroype specific
    - vaccine serotype must be same as those causing infection
    - attenuated vaccines can be transmitted to unvaccinated animals and could reassort with field strains; resulting in new viral strains
- Recombinant vaccines are under development

For more detailed information regarding vaccines, please refer to Chapter 2.1.3 Bluetongue in the latest edition of the *OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* under the heading "Requirements for Vaccines and Diagnostic Biologicals".

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

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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 April 2013.