

SCHMALLEMBERG VIRUS

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Schmallenberg virus was discovered in November 2011 and epidemiological, immunological and virological investigations are on-going in several European countries. The information presented in this technical factsheet reflects the epidemiological observations and research done to date (October 2013), together with data extrapolated from genetically similar viruses of the same genus and serogroup.

AETIOLOGY

Classification of the causative agent

The “Schmallenberg virus” (SBV) is an enveloped, negative-sense, segmented, single-stranded RNA virus. It belongs to the *Bunyaviridae* family, within the *Orthobunyavirus* genus. The Schmallenberg virus is a member of the Simbu serogroup viruses, which includes Shamonda, Akabane, and Aino viruses. The Simbu viruses which are most related to SBV are Sathuperi and Douglas virus.

Field and laboratory studies indicate a causal relationship between SBV infection and the reported clinical signs. .

Resistance to physical and chemical action

From extrapolation from the California serogroup of Orthobunyaviruses:

- Temperature:** Infectivity lost (or significantly reduced) at 50–60°C for at least 30 minutes.
- Chemicals/Disinfectants:** Susceptible to common disinfectants (1 % sodium hypochlorite, 2% glutaraldehyde, 70 % ethanol, formaldehyde)
- Survival:** Does not survive outside the host or vector for long periods

EPIDEMIOLOGY

According to the epidemiological investigations, reinforced by what is already known about the genetically related Simbu serogroup viruses, SBV infection is mainly reported from ruminants. Serological and epidemiological studies indicate that it is not zoonotic. Transmission in animals is by insect vectors and then vertically *in utero*.

Hosts

- Confirmed by PCR or virus isolation:
 - Cattle, sheep, goats
 - Bison
 - Roe deer
 - Dog (a single case of PCR positive dog)
- Confirmed by serology only:
 - Red deer
 - Alpacas
 - Mouflons
 - Wild boar

Transmission

- Epidemiological investigations indicate insect vector transmission.
- Vectors: SBV genome was detected in several *Culicoides* species. To date, there is no evidence that mosquitoes play a role.
- Vertical transmission across the placenta is proven.
- SBV has been found in bovine semen. However, the potential for transmission by insemination is unknown.
- Direct transmission from animal to animal has been investigated but has not been proven.

Viraemia and incubation period

Experimental infection in cattle and sheep showed no clinical signs or mild symptoms at 3 to 5 days post-inoculation with an incubation period of between 1 and 4 days and viraemia lasting for 1 to 5 days.

Sources of virus

Material found to be positive in virus isolation (up to October 2013):

- Blood from affected adults and brain from infected foetus.

Material found PCR positive (up to October 2013):

- Organs and blood of infected foetus, placenta, amniotic fluid, meconium.
- Following an acute infection, SBV RNA can be detected up to several weeks in different tissues like semen, lymphatic organs, especially in mesenteric lymph nodes, spleen.

Occurrence

Some Orthobunyaviruses had previously been reported in Europe but viruses from the Simbu serogroup had never been isolated in Europe before 2011.

Schmallenberg virus was first detected in November 2011 in Germany from samples collected in summer/autumn 2011 from diseased (fever, reduced milk yield) dairy cattle. Similar clinical signs (including diarrhoea) were detected in dairy cows in the Netherlands where the presence of SBV was also confirmed in December 2011.

Since early December 2011, congenital malformations were reported in newborn lambs in the Netherlands, and SBV was detected in and isolated from the brain tissue. Up to now, The Netherlands, Belgium, Germany, United Kingdom, France, Luxembourg, Spain, Italy, Switzerland, Austria and Ireland have reported stillbirth and congenital malformations with PCR positive results. In addition, further spread of SBV to many other countries was reported.

For 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>].

DIAGNOSIS

Clinical diagnosis

Manifestation of clinical signs varies by species: bovine adults have shown a mild form of acute disease during the vector season, congenital malformations have affected more species of ruminants (to date: cattle, sheep, goat and bison). Some dairy sheep and cow farms have also reported diarrhoea.

- Adults (cattle)
 - Usually inapparent, but non-specific signs including the following:
 - Fever (>40°C)
 - Reduced milk yield
 - Diarrhoea
 - Individuals recover within a few days
 - Abortion
- Malformed animals and stillbirths (calves, lambs, kids)
 - Arthrogryposis/ Hydranencephaly
 - Brachygnathia inferior
 - Ankylosis
 - Torticollis
 - Scoliosis

The incidence of malformation varies depending on the stage of gestation at the time of infection and on the species. In some synchronised sheep flocks, the incidence can be high. However at the country level, the morbidity is not significant.

Lesions

In malformed newborn:

- Hydranencephaly
- Hypoplasia of the central nervous system
- Porencephaly
- Subcutaneous oedema (calves)

The clinical signs can be summarised as arthrogryposis and hydranencephaly syndrome (AG/HE)

Differential diagnosis

For the acute infection of adults:

The clinical signs are not specific. All possible causes of high fever, diarrhoea, milk reduction and abortion should be taken into account.

For the malformation of calves, lambs and kids:

- Other Orthobunyaviruses
- Bluetongue
- Pestiviruses
- Genetic factors
- Toxic substances

Laboratory diagnosis

Samples

Samples should be transported cooled or frozen

From live animals for the detection of acute infection:

- EDTA blood
- Serum
 - At least 2 ml, transported cooled

From stillborns and malformed calves, lambs and kids:

- Virus detection:
 - Tissue samples of brain (cerebrum and brainstem)
 - Amniotic fluid
 - From live newborn:
 - Amniotic fluid and placenta
 - (Meconium)
- Antibody detection:
 - Pericardial fluid
 - Blood(preferably pre-colostral)
- Histopathology:
 - Fixed central nervous system, including spinal cord

Procedures

Identification of the agent

- Real-time RT-PCR (Bilk et al., 2012); commercial PCR kits are available
- Cell culture isolation of the virus: insect cells (KC), hamster cells (BHK), monkey kidney cells (VERO)

Serological tests on serum samples

- ELISA: commercial kits available
- Indirect Immunofluorescence
- Neutralization test

For further information, reference material and advice, refer to Dr Martin Beer (Martin.Beer@fli.bund.de), Institute of Diagnostic Virology, Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, Greifswald-Insel Riems, Germany.

Interpretation of the tests:

Serological results (ELISA) for index cases should be confirmed by sero-neutralisation tests.

PCR-positive results for index cases should be confirmed by sequencing.

PREVENTION AND CONTROL

There is currently no specific treatment for Schmallenberg virus.

Inactivated vaccines are commercially available in some countries.

Sanitary prophylaxis

Control of potential vectors during the vector-active season may decrease the transmission of virus.

Reschedule of breeding outside the vector season may decrease the number of foetal malformations.

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The OIE will update this Technical Factsheet when relevant
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Additional Information

MEAT

Relevant knowledge: Only clinically healthy animals should be slaughtered. The viraemic period is very short. Transmission of the virus is by vectors.

Risk of transmission to humans and animals: Negligible

MILK

Relevant knowledge: Milk should only be collected from clinically healthy animals. The viraemic period is very short. Transmission of the virus is by vectors.

Risk of transmission to humans and animals: Negligible

SEMEN

Relevant knowledge: Despite the very short viraemic period, SBV RNA could be detected in semen batches of SBV-infected bulls (Hoffmann et al, 2013 (a)). Furthermore, subcutaneous inoculation experiments proved the presence of infectious SBV in some of the PCR-positive bovine semen samples (Schulz, 2013 (b) submitted for publication).

Risk of transmission to animals: According to current knowledge, the risk is negligible for:

- semen batches collected before 31st of May 2011
- for semen batches from seronegative animals at least 28 days after semen collection.
- for semen batches tested for SBV-genome by an validated RNA-extraction method and RT-qPCR system.

EMBRYOS

Relevant knowledge: The viraemic period is very short. Embryos should be collected from clinically healthy animals. Akabane virus is classified under the category 4 (diseases or pathogenic agents for which studies have been done or are in progress that indicate that either no conclusions are yet possible with regard to the level of transmission risk; or the risk of transmission via embryo transfer might not be negligible even if the embryos are properly handled between collection and transfer).

Recommendation: Safety measures applicable to Akabane virus should thus be followed.

Risk of transmission: According to the current knowledge, the risk from sero-negative donor animals is negligible. Seropositive and PCR-negative donor animals at the day of insemination should be also considered with negligible risk.

LIVE NON-PREGNANT ANIMALS

Relevant knowledge: The viraemic period is very short. Mild clinical signs might occur. Transmission is by vectors.

Risk of transmission: Negligible for the following animals:

- PCR-negative after 7 days in a vector-free environment or,
- Seropositive and PCR-negative.

LIVE PREGNANT ANIMALS

Relevant knowledge: The virus can persist in the foetus; this may result in the birth of virus positive calves, lambs and kids.

Risk of transmission:

- Negligible for the offspring of animals held in a vector-protected environment tested with seronegative results after at least 28 days),
- Negligible for the offspring of animals seropositive before insemination,
- Undetermined for the offspring of all animals not covered by the previous bullets.