Variegated squirrel bornavirus 1 (VSBV-1)

Susceptible Species

Variegated squirrel bornavirus 1 (VSBV-1) has been detected in variegated squirrels and Prevost's squirrels (*Sciurus variegatoides* and *Callosciurus prevostii*). In addition, few cases have been observed in other exotic squirrel species. So far, detection in indigenous red squirrels (*Sciurus vulgaris*) has not been successful. At present, there is no indication that VSBV-1 also occurs in other animal species. Rare, usually fatal infections have, however, been diagnosed after transmission from infected squirrels to breeders and animal caretakers. Therefore, VSBV-1 is classified as a zoonotic pathogen.

Geographical Distribution

So far, VSBV-1 has been detected in squirrels kept in captivity in Germany, the Netherlands, and Croatia. Currently, it is unclear how the virus has been introduced into European squirrel holdings and if it also occurs in wild-living populations of the affected species.

Causative Agent

VSBV-1 belongs to the virus species *Mammalian 2 orthobornavirus*, genus *Orthobornavirus* within the family *Bornaviridae;* genetically it is most closely related to Borna disease virus 1 and 2 (BoDV-1 and -2). BoDV-1 occurs in bicolored white-toothed shrews (*Crocidura leucodon*) in parts of Central Europe. In the rare case of transmission to domestic mammals and humans, it can also cause severe, usually fatal encephalitis.

Transmission

The transmission routes of VSBV-1 between squirrels and to humans are still unknown. Injuries, such as scratches or bites, or contact with virus-contaminated excretions are considered to be possible infection routes. Based on the current knowledge, direct human-to-human transmission does not occur.

Symptoms

VSBV-1-infected squirrels neither display symptoms of disease nor organ changes. Infected humans, however, may develop severe encephalitis, which leads to death two to four months after onset of the first clinical symptoms.

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Diagnostics

The FLI has developed and validated molecular diagnostic and serological tests for detection of the virus and antibodies against the pathogen. As the virus usually can be detected in saliva and feces of infected squirrels, the FLI recommends to submit two dry oral swabs and a fecal sample of each animal for testing.
Additional serological investigation of a blood or serum sample may be helpful to assess the infection status. When squirrels have been euthanized or have died, the entire body should be sent in for investigation either refrigerated or frozen.
Samples for investigation should be sent to the Institute of Diagnostic Virology, Friedrich-Loeffler-Institut, Südufer 10, 17493 Greifswald-Insel Riems, to the attention of Dr. Dennis Rubbenstroth (dennis.rubbenstroth@fli.de). Please notify the FLI in advance and use the sample submission form.
In case of questions on diagnostics in humans please contact the Bernhard-Nocht-Institute for Tropical Medicine in Hamburg (Dr. Dennis Tappe; tappe@bni-hamburg.de).

Control

Due to the risk of transmission to humans, the FLI recommends to have all squirrel holdings tested for VSBV-1 and to implement targeted control measures in positive holdings. To avoid a spread of the virus within the holding, the FLI recommends to euthanize squirrels which have been tested positive and make them available to the FLI for further investigation. To exclude further infections within the holding, it is recommended to repeat sampling of the entire holding after 3 months. For holdings tested negative, regular re-testing at 6-month-intervals is recommended. Furthermore, it is recommended to test all squirrels prior to selling. Newly introduced squirrels should originate from holdings with a known negative infection status. They should be tested immediately after purchase and re-tested after six months. If possible, the animals should be kept separately until receipt of the second negative test result after six months.

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