

”classical” Borna disease virus 1 (BoDV-1)

Susceptible Species

The reservoir host of „classical“ Borna disease virus 1 (BoDV-1) is the bicolored white-toothed shrew (*Crocidura leucodon*; order Eulipotyphla). However, natural or experimental transmission of the virus to other mammal species, so-called dead end hosts, is also possible and can cause severe encephalitis. This has been reported mainly in horses and sheep. In March 2018, human BoDV-1 infections as dead end host were clearly confirmed for the first time. Therefore, BoDV-1 has to be classified as a zoonosis.

Geographical Distribution

BoDV-1 occurs in bicolored white-toothed shrew populations in parts of Germany, Austria, Switzerland, and Liechtenstein. As dead end hosts such as horses, sheep or humans do not spread the virus, infection and disease in these species almost exclusively occur in these regions. According to the current knowledge, reports of a worldwide distribution of the virus in humans and other species are based on erroneous laboratory results.

Causative Agent

BoDV-1 belongs to the virus species *Mammalian 1 orthobornavirus*, genus *Orthobornavirus*, family *Bornaviridae*. The closest relative is BoDV-2, which belongs to the same virus species and so far has only been detected in one diseased horse in Styria (Austria). Another relative is the variegated squirrel bornavirus 1 (VSBV-1), which has been detected in exotic squirrel species kept in captivity in Europe. VSBV-1 can also cause severe encephalitis if transmitted to humans.

Transmission

The transmission routes between bicolored white-toothed shrews and to dead-end hosts are not fully understood. Infected bicolored shrews excrete the virus among others with feces and urine. Direct contact with infected shrews, their carcasses or excretions, ingestion of contaminated food or water, as well as injuries such as scratches or bites are possible infection routes. According to the current knowledge, dead end hosts neither excrete nor transmit BoDV-1. In humans

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however, a case of virus transmission by solid organ transplantation has been reported.

Symptoms BoDV-1-infected bicolored white-toothed shrews appear healthy and do not show any distinctive organ changes. Infected dead end hosts including humans, however, can develop severe encephalitis, which is known as Borna disease in animals. In most cases, the disease leads to death within few weeks to several months after onset of the first symptoms.

Diagnostics The FLI has established molecular diagnostic and serological test methods for detection of BoDV-1 and antibodies against the virus in animals. In bicolored white-toothed shrews, the virus can be detected in different organs and excretions. In dead end hosts, such as horses, sheep or humans, the virus usually can only be detected in the brain and occasionally in small amounts in cerebrospinal fluid. In dead end hosts, blood or swab samples are not suitable for detection of virus components. Blood and liquor samples, however, can be used for serological detection of antibodies against BoDV-1. As a rule, in live patients this is the only possibility to detect the infection. For questions on bornavirus diagnostics at the FLI, please contact Dr. Dennis Rubbenstroth (Dennis.Rubbenstroth@fli.de). Serological and molecular biological detection methods for human BoDV-1 infections are available at the Bernhard-Nocht-Institute for Tropical Medicine (BNITM) in Hamburg from serum, liquor and brain samples. In case of questions on bornavirus diagnostics at the BNITM please contact Prof. Dr. Dennis Tappe (tappe@bnitm.de).

Control The most important prophylactic measure is avoiding direct and indirect contact with potentially infected bicolored white-toothed shrews. Particularly in the known distribution area of BoDV-1, live and dead shrews should not be touched with bare hands. Objects which have been exposed to shrews should be cleaned and disinfected. Animal holdings located in the distribution area should take efficient measures to keep small mammals, in particular shrews, out of the animal houses. As according to the current knowledge no risk of transmission emanates from infected dead end hosts, it is not necessary to separate animals that have been tested positive.

Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health
Südufer 10, D-17493 Greifswald - Insel Riems, www.fli.de