



TBE VIRUS FOCI IN NORTHERN GERMANY

Background

In Germany, the National Institute of Public Health (Robert Koch-Institut, Berlin) classifies a district (a county) as a TBE risk area if the five-year incidence in humans exceeds 1 per 100,000 inhabitants. Nearly 90% of the risk areas are located in the two federal states of Bavaria and Baden-Württemberg (both in southern Germany). However, it has been observed that TBE virus is spreading more northwards, and consequently more sporadic cases have recently been reported in regions outside of the classical TBE risk areas in southern Germany. This is also true for the northern federal state of Lower Saxony where several districts reported human TBE cases in recent past despite only one district (“Emsland”) having been classified as a TBE risk area.

TBE virus circulates in small mammals and ticks in geographic restricted areas as small as 50m x 50 m (termed microfoci), and virus transmission may take place in larger areas of up to 1 km or more in diameter by dispersal of rodents. The prevalence of TBE virus in ticks in these foci may be low, often with a minimal infection rate (MIR) of less than 1%, and thus the detection of TBE virus in ticks is cumbersome and time-consuming. A team of German scientists has studied microfoci in Lower Saxony and has phylogenetically characterized TBE virus isolates found in these foci.

Results

A total of 20,056 *Ixodes ricinus* ticks (80.7% nymphs and 19.3% adult ticks) were collected at eight different locations in Lower Saxony. Of 2416 pools (up to 10 nymphs or five adult ticks), 18 pools (0.75%) from four locations were positive for TBE virus RNA (analyzed by RT-qPCR). For the first time, TBE virus could be detected in ticks in the area “Lingen East” located in the TBE risk area of “Emsland”, and which were all collected on the same stretch of path of only 200 m (MIR: 0.33%). TBE virus detection was also successful in the area

“Lingen West” close to “Lingen East” and about 200 m away from a spot where positive pools have already been identified in 2019. Additional TBE positive foci could be found in other regions of Lower Saxony (near Hanover in eastern Lower Saxony and near Cuxhaven in northern Lower Saxony close to the North Sea).

Sequencing the glycoprotein E gene of TBE virus revealed that various isolates showed a high genetic identity among each other and were related to the Finnish strain Kuutsalo_14, while other isolates were phylogenetically more related to the strain Battaune which had been isolated in Saxony (Eastern Germany).

Discussion

In this study, continuous virus circulation could be revealed in some areas as well as first detection of microfoci in areas where human cases had been reported. The TBE virus positive foci “Lingen West” and “Lingen East” are only 3.8 km away from each other, but are separated by a highway, a river, and a canal. It was concluded that direct virus transmission may have happened via tick-infested or viremic animals (e.g., birds). TBE virus could be detected in areas more than 10 years prior, underlining long-term stability of TBE foci.

MIR in TBE virus positive areas was low (0.00%–0.33% in nymphs and 0.00%–0.51% in adult ticks), which is in line with earlier observations. Also, year-to-year variations in prevalence exist and could be demonstrated.

Near “Lingen”, the isolated strain showed high genetic homology to a Finnish isolate. There is a classical bird migration route from northern Europe to southwestern Europe: Kuutsola-Finland -Bornholm-Cuxhaven-Lingen, and birds may carry infected ticks when migrating. Of interest is also the strain which has a close relationship to the strain Battaune, which has a close relationship to Polish isolates, and which circulate in *Dermacentor reticulatus* ticks. However, this tick



species cannot be found on birds, and thus its transmission to Lower Saxony remains open.

Detection of TBE virus has not been successful in all places of presumptive TBE-positive sites. Reasons for this may be that the number of collected ticks was too low, the investigated region was too large to identify a small microfocus, or the TBE patient was infected by a tick at another place than supposed. These negative results are difficult to interpret and in the end show that the identification of TBE virus microfoci is subject to various imponderability.

Literature

Topp et al.

New and confirmed foci of tick-borne encephalitis virus (TBEV) in northern Germany determined by TBEV detection in ticks

Pathogens. 2022;11(2):126. doi:10.3390/pathogens11020126

Author: Dr. Michael Bröker

Compiled: April 2022
