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Genetic and biological comparison of tick-borne encephalitis viruses from Hokkaido and far-eastern Russia

Akiko Goto

Laboratory of Public Health,
Department of Environmental Veterinary Sciences,
School of Veterinary Medicine,
Hokkaido University, Sapporo, Japan

In October 1993, a human case of encephalitis was diagnosed as tick-borne encephalitis (TBE) in Kamiiso, Hokkaido. The virus strain Oshima 5-10 was isolated from dogs in the same area in 1995, and identified as TBE virus of the Far-Eastern subtype [Russia Spring-Summer Encephalitis (RSSE)] from analysis of antigen and viral envelope (E) protein gene nucleotide sequences. Previous study showed that Oshima 5-10 strain had lower virulence and slower virus replication in mouse brain than TBE virus Sofjin-HO strain in mouse model. However, sequence analyses of the E protein gene of Oshima 5-10 strain showed high amino acid sequence identity with Sofjin-HO strain, so another protein gene may influence the difference of the virulence between the two strains. In this study, we compared biological properties of the two strains such as plaque formation, virus replication and virus protein synthesis in BHK-21 cell culture. We also determined the complete nucleotide sequences of both strains and compared the deduced amino acid sequences.

First, plaque sizes of Oshima 5-10 strain were smaller than those of Sofjin-HO strain. Next, virus titers in culture fluid of Oshima 5-10 strain were 1/100 fewer than those of Sofjin-HO strain at 9 and 12 hours after virus infection. As revealed by IFA technique, viral antigen positive cells in Oshima 5-10 strain infected culture were fewer than those in Sofjin-HO strain at 6 and 9 hours after virus infection. These results indicate that Oshima 5-10 strain replicates slower than Sofjin-HO strain in BHK-21 cell culture.

In genetic analysis of the two strains, Oshima 5-10 strain possesed a total of 1.4% amino acids difference with Sofjin-HO strain. But, difference between two strains were not detected in motif sequence of NS 3 serin protease/helicase, NS 5 RNA dependent RNA polymerase/ methyltransferase, cleavage sites of virus protein and glycosylation sites of NS 1.