

Rogulska, Karolina, Kapczuk, Patrycja, Ziolo, Anna, Sarna, Angela, Jacek, Roksana, Grzeszczak, Konrad. Tick-borne encephalitis virus (TBEV), is the disease still dangerous? *Journal of Education, Health and Sport*. 2022;12(12):94-98. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2022.12.12.014> <https://apcz.umk.pl/JEHS/article/view/40088> <https://zenodo.org/record/7324476>

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences). Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przynależność dyscypliny naukowej: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu). © The Authors 2022. This article is published with open access at License Open Journal Systems of Nicolaus Copernicus University in Torun, Poland Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited. The authors declare that there is no conflict of interests regarding the publication of this paper. Received: 06.09.2022. Revised: 29.10.2022. Accepted: 10.11.2022.

TICK-BORNE ENCEPHALITIS VIRUS (TBEV), IS THE DISEASE STILL DANGEROUS?

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ABSTRACT

Tick-borne encephalitis virus (TBEV) belongs to the family Flaviviridae. Flaviviruses are 50 nm viruses having a membrane envelope with an RNA genome. The vector of TBEV is the common tick (*Ixodes ricinus*) prevalent mainly in Europe. Tick-borne encephalitis is endemic in 27 countries in Europe. According to the National Institute of Hygiene, there are several hundred cases per year in Poland. Diagnosis of TBEV may be based on serological tests,

molecular tests, cerebrospinal fluid examination. Prevention of tick-borne encephalitis is based on several aspects and the most important are the non-compulsory vaccinations. TBEV is a disease characterised by the risk of many complications, which can be irreversible. Fortunately, thanks to developments in vaccinology, vaccinations are available to prevent infection or reduce the severity of the disease.

Keywords: tick-borne encephalitis virus; *Ixodes ricinus*; vaccinology

INTRODUCTION

Tick-borne encephalitis virus (TBEV) belongs to the family Flaviviridae. Flaviviruses are 50 nm viruses having a membrane envelope with an RNA genome. (Heinz and Allison 2003). The vector of TBEV is the common tick (*Ixodes ricinus*) prevalent mainly in Europe (Gritsun et al. 2003). The tick-borne encephalitis virus is transmitted during a tick bite via saliva. Even rapid removal of the parasite does not protect against infection, because the virus is transmitted just minutes after contact (Alekseev and Chunikhin 1990).

Tick-borne encephalitis is endemic in 27 countries in Europe (Riccardi et al. 2019). According to the National Institute of Hygiene, there are several hundred cases per year in Poland. The number of infections varies depending on the region of the country. In the course of this disease, the number of hospitalisations is extremely high - at almost 100% (Table 1).

Table I. Tick-borne encephalitis in Poland 2017-2021 based on data from The National Institute of Public Health.

Poland	Number of cases per quarter				Number of cases per year	Incidence per 100,000 inhabitants	Hospitalization	
	I	II	III	IV			Number	%
2017	8	33	101	141	283	0,74	283	100
2018	12	31	83	71	197	0,51	197	100
2019	21	41	104	99	265	0,69	265	100
2020	12	22	98	26	158	0,41	158	100
2021	8	27	128	47	210	0,55	207	98,6

Tick-borne encephalitis develops in a few days after the tick bite. The average time is eight days (Kaiser 1999). The disease usually follows a two-stage course. The first stage is asymptomatic in a significant number of people. In others, flu-like symptoms may appear, such as fever, muscle pain, fatigue and general malaise (Mickiene et al. 2002). Laboratory tests show leukopenia and thrombocytopenia (Furlan and Strle 1995). The next phase of the disease is characterised by neurological symptoms such as headache, ataxia,

tremor or spinal nerve palsy (Duniewicz et al. 1975). The severity of the disease varies from mild meningitis to encephalitis that can progress with or without myelitis (Lorenzl et al. 1996). A tick-borne encephalitis infection is associated with the risk of numerous complications including paralysis and paresis, so that is why quick and targeted diagnosis of the disease is so important.

DIAGNOSTICS

Serological tests

The diagnosis of tick-borne encephalitis is based on the detection of IgM- and IgG-class antibodies in blood or cerebrospinal fluid (CSF) using an immunoenzymatic test, e.g. ELISA (Holzmann 2003). These tests show high sensitivity, but may have lower specificity between viruses of the family of *Flaviviridae* (Weissbach and Hirsch 2015). In the course of the disease with neurological symptoms, antibodies of both classes are usually present, although sometimes only IgM antibodies are present. In this case, the tests should be repeated after about two weeks, since the recommendation is that antibodies of both IgM and IgG classes are necessary for a diagnosis of tick-borne encephalitis (Bogovic and Strle 2015). Due to the limitations of the ELISA test, a neutralisation test is recommended for people who may come into contact with flaviviruses (Taba et al. 2017). On the other hand, those who have developed infection despite vaccination should be shown to have antibodies in the PMR (Kaiser 1999).

Molecular tests

Polymerase chain reaction-PCR for the diagnosis of TEBV is only useful in the first phase of the disease, before seroconversion and neurological symptoms develop. (Patel et al. 2013). In the second phase of tick-borne encephalitis, PCR has no diagnostic value (Achazi et al. 2011).

Cerebrospinal fluid examination

In patients with suspected tick-borne encephalitis, a lumbar puncture can be performed (Deisenhammer et al. 2006). CSF mononuclear pleocytosis $> 5 \times 10^6$ cells/l is a diagnostic marker for TBEV, with the presence of IgM and IgG class antibodies in serum and a characteristic clinical presentation (Steiner et al. 2010).

PREVENTION

Prevention of tick-borne encephalitis is based on several aspects. First and foremost, it is important to prevent tick bites. For this purpose, light-coloured and tight clothing should be used in high-risk areas. In addition, it is advisable to use repellents which are intended to deter ticks. After returning from endemic areas, the whole body should be examined. If a tick is found, the parasite should be removed as soon as possible (Lindquist and Vapalahti 2008).

Non-mandatory vaccination against tick-borne encephalitis is also available. According to World Health Organization (WHO) In areas where the infection rate exceeds 5 cases/100,000 persons/year, population-based vaccination is indicated.

SUMMARY

Ticks are the most common vector of tick-borne encephalitis, so always do a self-examination when returning, i.e. from the forest. TBEV is a disease characterised by the risk of many complications, which can be irreversible. Fortunately, thanks to developments in vaccinology, vaccinations are available to prevent infection or reduce the severity of the disease.

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