

Tick-borne encephalitis in children and adolescents in the Czech Republic between 1960 and 2007

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Background: The Czech Republic ranks among the countries with the highest prevalence of tick-borne encephalitis worldwide. The region of West Bohemia has the second highest morbidity within the Czech Republic.

Methods: Between 1960 and 2007, laboratories confirmed 410 cases of tick-borne encephalitis in children and adolescents of West Bohemia. Available epidemiological data were analyzed.

Results: The highest incidence (per 100 000 population) was found in the group of 15-19 years for both genders (males: 6.2; females: 4.3). Data on the consumption of non-pasteurized milk were found in 5.4% of patients. The preschool age group showed its highest incidence in June and September, and the risk of infection for older children was in July and August.

Conclusions: The current low coverage of vaccination leads to an insignificant improvement to the overall frequency of this disease.

World J Pediatr 2012;8(4):363-366

Key words: children;
tick-borne encephalitis;
transmission;
vaccines

Introduction

The Czech Republic (CR) along with the Baltic States, Russia and Slovenia, ranks among the countries with the highest prevalence of tick-

borne encephalitis (TBE) worldwide.^[1] Although there are several hundred pediatric infections per year in Europe alone, the specialized literature pays little attention to the epidemiological characteristics of the disease.^[2-5]

Since records began, the former region of West Bohemia (now the two regions of Pilsen and Karlovy Vary) has the second highest morbidity within the CR, closely following that of South Bohemia. The annual incidence of the disease in the West-Bohemian Region (hereafter WBR) varied from 0.5 to 10.4 per 100 000 population between 1960 and 2005.^[6] This report comprises the longest (48-year) retrospective survey of pediatric TBE cases from a single geographical region focusing on basic epidemiological characteristics.

Methods

Between 1960 and 2007, laboratories confirmed 1767 TBE cases in the inhabitants of West Bohemia (average population of 863 306). The available diagnostic ways used during the period of this study were the complement-fixation reaction, the hemagglutination-inhibition test, the virus neutralization test, indirect immunofluorescence and ELISA. Individual cases were classified on the basis of clinical and laboratory criteria (IgM, IgG in serum or cerebrospinal fluid, seroconversion, significant antibody increase in the tests). Epidemiological surveys were performed by the staff of West-Bohemian Hygiene Stations. For each patient, the data were collected on age, sex, date of start of illness, death, place of living, place of infection, district, altitude, history of a tick bite and vaccination. Since 1993, data on the consumption of unpasteurized goat's, sheep's, and cow's milk of infected people have been kept. Since 1991, vaccination centers and vaccinating general practitioners have been making annual reports of the numbers of persons in each age group who have received the third TBE vaccine. Available epidemiological data were selected to form an independent computer database using the EPI-Info 6.04 program. Within this database, 410 cases of infection in children and adolescents were analyzed, all falling into

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doi: 10.1007/s12519-012-0383-z

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the above mentioned period with an average population of 248 848. The results were processed statistically using the chi-square test. The level of significance was set at 0.05.

Results

Trends in the occurrence of TBE in West Bohemia are shown in Fig. 1. The total incidence in children and adolescents over the analyzed period was 3.4 cases per 100 000 population. One 15-year-old boy died (0.2% of the total). Around 63.2% (259/410) of infected persons were males ($P=0.00001$, $\chi^2=18.96$). The incidence varied in different age groups (0-4, 5-9, 10-14, 15-19 years) from 1.6 to 6.2 per 100 000 population in boys, and from 0.8 to 4.3 per 100 000 population in girls. The highest incidence occurred in the group of 15-19 years olds in both sexes (6.2 per 100 000 population for males and 4.3 per 100 000 population for females). The incidence for individual periods (decades) analyzed in 10 districts of the region are presented in Table. Of the 410 infected persons, 378 (92.2%) were probably

infected within the WBR. No infections contracted abroad were reported.

The altitude of the areas where TBE was transmitted in the WBR ranged from 310 to 985 meters above sea level with no statistical differences between individual periods. A history of tick bite was reported by 59.0% of the infected persons. The consumption of unpasteurized milk, which was determined separately with no simultaneous history of a tick bite, was ascertained in 11 (5.4%) of 203 sick children. During the five monitored periods, the average seasonal peak was reported three times in July, and once in June and August (Fig. 2). The proportion of infections in October and November gradually increased to 7.5%. About 19.0% of infections in children in the age group of 0-4 years occurred during July and August, while in older children of school-age groups, the percentage was 62.2% for age of 5-9 years, 56.7% for age of 10-14 years, and 56.0% for age of 15-19 years. The difference between the risk of contracting the disease in pre-school and school children during the holiday months was statistically significant ($P=0.0005$, $\chi^2=11.99$).

Totally 20 640 children and adolescents from the

Table. Tick-borne encephalitis in the districts of the West-Bohemian Region (currently Pilsen and Karlovy Vary Regions), 1960-2007

Districts (region)	Period 1960-1969 abs (rel)	Period 1970-1979 abs (rel)	Period 1980-1989 abs (rel)	Period 1990-1999 abs (rel)	Period 2000-2007 abs (rel)
Domažlice (P)	8 (4.2)	4 (2.2)	1 (0.6)	5 (3.2)	9 (8.6)
Cheb (KV)	-	-	-	3 (1.3)	5 (3.1)
Karlovy Vary (KV)	-	-	1 (0.3)	3 (0.9)	6 (2.8)
Klatovy (P)	5 (1.6)	4 (1.5)	9 (3.4)	24 (10.3)	22 (14.6)
Plzeň-město (P)	15 (3.9)	24 (5.8)	28 (5.7)	46 (10.8)	22 (8.7)
Plzeň-jih (P)	5 (2.2)	9 (4.4)	10 (5.1)	18 (10.5)	14 (11.9)
Plzeň-sever (P)	8 (3.2)	13 (5.8)	7 (3.2)	21 (10.8)	8 (6.0)
Rokycany (P)	-	3 (2.3)	2 (1.5)	13 (11.0)	9 (11.6)
Sokolov (KV)	-	-	-	1 (0.4)	1 (0.5)
Tachov (P)	4 (2.2)	5 (2.9)	-	5 (3.3)	10 (10.1)
Total (WBR)	45 (1.6)	62 (2.3)	58 (2.2)	139 (6.0)	106 (7.1)

abs: absolute numbers of cases; rel: incidence per 100 000 population.

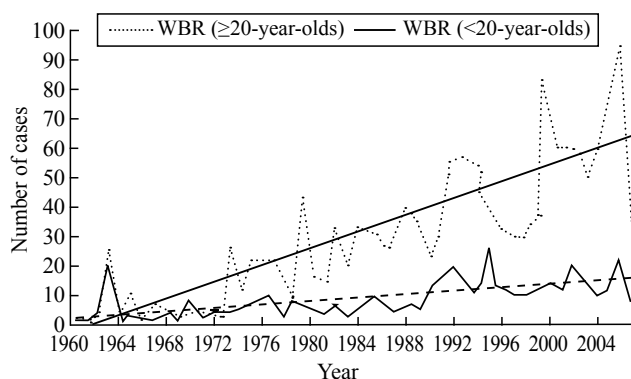


Fig. 1. Cases of tick-borne encephalitis in different age groups in the West-Bohemian Region (1960-2007).

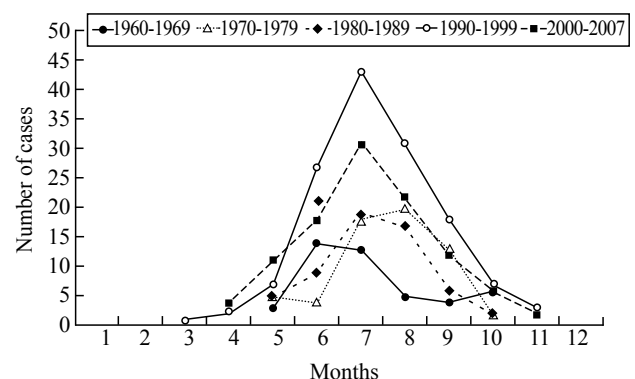


Fig. 2. Seasonal occurrence of tick-borne encephalitis in the West-Bohemian Region, 1960-2007.

Pilsen Region (13.7%) had received at least three doses of vaccination against TBE by July 31, 2007.

Discussion

Long-term analyses of TBE are rare and surveys concerning this infection in children are even less frequent.^[2-12] Similar analysis has not been made in other Czech regions, data from the neighbouring countries are focused rather on the analysis of clinical courses and vaccinations. The development of this disease in the young population was shown to reflect developmental trends in the whole population of West Bohemia and, more generally, of the CR.^[13]

Analysis of the incidence in the monitored periods confirmed significant changes in the spread of infection in certain parts of the region. The incidence in the Klatovy District is currently the highest. The data on the low number of infections contracted during a long-distance travel have confirmed what was previously known of TBE as a disease associated with the leisure time spent in the immediate proximity of one's permanent residence. The risk of infection concerning the youngest children is also associated with outdoor activities of adults, i.e., parents or grandparents.

Like in other countries, TBE has a male preponderance in the CR. In Slovenian and Swiss surveys, boys represent 62.8% and 69% of TBE cases, respectively.^[3,5] The mortality in our study reflects the experience of other European countries where the general mortality rate ranges from 0 to 1.4%.^[2,7-9] However, lethal cases in children occur rarely.^[14]

In the literature, there are very few references to long-term surveys of the risk of infection from unpasteurized milk. Such cases of infection are known in Germany and Austria, but more predominantly in eastern parts of Europe.^[1] The persistence of this form of transmission reflects unchanging habits of certain sections of the population, even in the developed countries.

In connection with global climatic changes, the spread of natural areas of TBE to higher altitudes has been a subject of discussion in recent years.^[15] Until the 1990s, the altitudinal limit of tick occurrence in the CR was considered to be 700 meters above sea level. However, current studies performed in Czech mountains show the shift of this limit to higher altitudes. The mere occurrence of ticks does not automatically mean transmission of infection to people. This is confirmed by the data from West Bohemia; an increase in the risk of transmission cannot yet be proven. However, the influence of climatic changes is probably already affecting the seasonality of this infection.^[16,17] While in the 1960-80s, the infection in children used to be

reported from May to October, and the situation has changed since then. Currently, transmissions in March are no longer exceptional, and in recent years, new cases of infection have been reported as late as the end of November. An independent analysis of seasonality within different age groups shows that the risk of infection in preschool children peaks in June and September, as their parents often prefer holidays outside the standard school holidays period for the whole of the CR (from July 1 to August 31).

An increase of TBE incidence in risk areas has been observed in many endemic countries especially in the last decade. It is difficult to implicate the climate change as the main cause of the increase in TBE incidence^[13,18,19] because of a complex interrelation of several influences, such as social, political, ecological, demographic and technological factors (e.g., advanced diagnostics and increased medical awareness).

Since 1990, the FSME-IMMUN vaccine (currently Baxter) has been available in the CR, followed by the Encepur vaccine (currently Novartis) in 1996. Because there is no central monitoring of this vaccination, our data on the population in the Pilsen Region is limited; however, the real vaccination coverage might only slightly exceed the figures for this region. The fact that there have been no reported failures of the vaccine is an indirect confirmation of the high efficacy of TBE vaccination in the young population. A certain sign of improvement in young age groups is the decreasing share of incidence of this subpopulation in the total incidence in the WBR. While in the 1960s the incidence in the youngest age group reached 38%, currently it is only 16%; this rate is equivalent to that of a long-term study carried out in Slovenia.^[3] This favorable trend is, however, significantly influenced by the general aging of the population in the CR. The situation in Austria, for example, is completely different; the exceptionally good figures of infection at an early age are primarily brought about by the high vaccination coverage of Austrian children.^[12,20]

The collection of epidemiological data is indispensable for predicting endemic foci and recommending preventive measures. Unless the vaccination coverage rises simultaneously with a decrease in high-risk behavior such as drinking unpasteurised milk, a major change in the epidemiological situation cannot be expected.

Funding: None.

Ethical approval: Not needed.

Competing interest: The authors declare that there is no conflict of interest.

Contributors: Pazdiora P proposed the study and wrote the main body of the article, Štruncová V and Švecová M analyzed the data. All authors contributed to acquisition of data, the design

and interpretation of the study and to further drafts, and to the intellectual content and approved the final version. Pazdiora P is the guarantor.

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Received August 11, 2011

Accepted after revision January 4, 2012