

FEBRILE CONVULSIONS IN CHILDREN IN THE TUZLA CANTON: A 6-YEAR EPIDEMIOLOGICAL STUDY

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Objective The research was carried out in order to establish by retrospective research the incidence of febrile convulsions (FC) in the area of the Tuzla Canton.

Methods Using a retrospective cohort study, children were included from the age of one month to 7 years of life, who lived in the Tuzla Canton and who were hospitalized for their first FC at the Department of paediatrics in Tuzla in the period from 1.1.1999 to 31.12.2004. From this documentation data was analyzed related to the age and sex of the children, the type of FC attack and the seasonal frequency.

Results The total annual incidence of FC in children of both sexes was 3.0/1000 (95%CI 2.8-3.3), 3.2/1000 for boys, and 2.9/1000 for girls.

Conclusion The results are the first epidemiological indicators of FC in Bosnia and Herzegovina and are a good foundation for future monitoring, since they may be useful in planning preventive, organizational and therapy programs for paediatric health care in this region.

Key words: Febrile convulsions ▪ Incidence ▪ Epidemiology ▪ Tuzla Canton

Introduction

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Febrile convulsions (FC) are the most frequent neurological disorder of early childhood (1). The International League Against Epilepsy defines them as attacks which occur in children after the first month of life in febrile illnesses, which do not cause an infection of the central nervous system and where there were no earlier neo-natal or unprovoked attacks (2).

The main, but probably not the only, precipitating factor for the occurrence of FC is a high body temperature. They most often occur in the form of generalized tonic-clonic seizure with sudden loss of consciousness and a long apnoeic pause. In terms of clinical characteristics they are divided into simple and complex FC. Attacks lasting up to 15 minutes without focal characteristics or repetition within 24 hours are characterised as simple FC, and attacks lasting longer than 15 minutes, with focal characteristics and repetition within 24 hours are characterised as complex FC (3). They are significant because of their high frequency, dramatic clinical picture, the possibility of meningo-encephalitis, and in comparison with children who have not had FC in early childhood, there is a greater risk of the occurrence of epilepsy in later life. FC which do not last long do not cause brain damage, neither do they have a negative effect on the intellectual development of the child (4). The cumulative incidence of FC in the world varies greatly from 0.5% to 1.5% in China, 8.8% in Japan, to as much as 14% in Guam. In western European countries and the United States, the cumulative incidence is around 2 to 5% (5). According to figures from prospective studies undertaken in Sweden and Malaysia of those suffering from their first FC, there is a slightly larger proportion of male children (6) of about 1.7:1 to 1.5:1 (7).

Simple attacks occur in 70% cases, and between 9% and 35% are complex attacks, where there is an increased risk of the occurrence of afebrile attacks later (8). Epidemiological data on FC in Bosnia and Herzegovina are not known.

The aim of the research was to establish the incidence of FC in the area of the Tuzla Canton (TC), in terms of the age and sex of the patients, the type of attack and the seasonal occurrence, and to examine the trends of this disturbance in the period from 1.1.1999 to 31.12. 2004.

Methods

The area of research

The Tuzla Canton is an administrative unit of the Federation of B&H (Figure 1), in the north-eastern part of Bosnia & Herzegovina. It covers an area of 2649 km², with a population of 233 628 children aged from one month to 7 years in the period from 1.1.1999 to 31.12.2004.



Figure 1 Geographical location of the Tuzla Canton area
Slika 1 Geografski položaj Tuzlanskog kantona

In this retrospective cohort study, children were included aged from 1 month to 7 years of life who were living in the area of the TC and who were admitted into hospital due to their first FC at the Children's Hospital in Tuzla in the period from 1.1.1999 to 31.12.2004. The primary source of data on the number of children with FC were medical records from the Children's Hospital, and the secondary independent source were data from 13 health centres in the TC. From this documentation data was analyzed relating to the age and sex of the children, the type of FC attack and the seasonal frequency. The entire population of subjects was divided into four groups on the basis of age: from 1 to 12 months (the first group) from 13

months to 2.9 years (second group) from 3 to 4.9 years (third group) and 5 to 7 years (fourth group), later mentioned as the infant, young, middle and older groups. Children were not included in the study who had an infection of the central nervous system or unprovoked attacks before the FC.

The figures on the total number of children in the TC from 1 month to 7 years for the period from 1.1.1999 to 31.12.2004 were obtained from the Federal Ministry of Statistics of the Federation of Bosnia and Herzegovina (9).

The total incidence rate and the specific rates for age and sex were calculated for the period from 1.1.1999 to 31.12.2004 as the number of children aged from 1 month to 7 years with FC per 1000 children of the same age.

Statistical analysis

Confidence intervals (95% CI) for incidence

rates were assessed by Poisson counts. The differences in incidence of FC between girls and boys in the test groups were analysed by the One-way ANOVA test. Seasonal and age variations were tested by the c2 test. Linear regression coefficients in time trend analysis of incidence rates was assessed by the Fisher's test (10). Statistical hypotheses were tested at a level of significance of $\alpha = 0.05$, that is the difference between the samples was considered significant if $P < 0.05$. The results were tested using the Arcus Quickstat program (11).

Results

Table 1 shows the incidence of FC in children aged from 1 month to 7 years in terms of age groups and sex, in the period from 1.1.1999 to 31.12.2004 in the Tuzla Canton.

The average incidence rate for FC in the period in question for both sexes was

Table 1 The Incidence of febrile convulsions in children aged from one month to 7 years in terms of age group and sex in Tuzla Canton

Tabela 1 Incidencija febrilnih konvulzija u djece Tuzlanskog kantona u dobu od jednog mjeseca do sedam godina u odnosu na dobne grupe i pol

| Age group/ Dobne grupe | Boys/Dječaci | | | Girls/Djevojčice | | | Total/Ukupno | | |
|------------------------------|------------------|-------------------------------------|--|------------------|-------------------------------------|--|------------------|-------------------------------------|---|
| | FC/ FK (n) | Popu- lation/ Popu- lacija | Incidence rate/Stopa incidence (95% CI) | FC/ FK (n) | Popu- lation/ Popu- lacija | Incidence rate/Stopa incidence (95% CI) | FC/ FK (n) | Popu- lation/ Popu- lacija | Incidence rate/ Stopa incidence (95% CI) |
| Infant/ Dojenička | 90 | 16354 | 5.5 (4.6-7) | 105 | 15533 | 6.7 (5.5-8.1) | 195 | 31887 | 6.1 (5.3-7.0) |
| Young/ Mlađa | 228 | 34601 | 6.5 (5.7-7.5) | 189 | 32513 | 5.8 (5.0-6.7) | 417 | 67114 | 6.2 (5.6-6.8) |
| Middle/ Srednja | 58 | 36067 | 1.6 (1.2-2.1) | 28 | 33806 | 0.8 (0.5-1.2) | 86 | 69873 | 1.2 (0.1-1.5) |
| Older/ Starija | 11 | 33576 | 0.3 (0.2-5.8) | 7 | 31178 | 0.2 (0.1-0.4) | 18 | 64754 | 0.3 (0.1-0.4) |
| Total/ Ukupno | 387 | 120598 | 3.2 (2.9-3.5) | 329 | 113030 | 2.9 (2.6-3.2) | 716 | 233628 | 3.0 (2.8-3.3) |

FC = Febrile convulsions/FK = Febrilne komvulzije

3.0/1000 (95% CI 2.8-3.3). For boys it was 3.2/1000, and for girls 2.9/1000. The difference in the incidence of FC between boys and girls was not statistically significant ($p = 0.379$). In the infant and young age groups the total incidence of FC was the highest at 6.1/1000 and 6.2/1000 respectively. Separated by sex, the incidence of FC in boys in the infant group was 5.5/1000 and in girls 6.7/1000 and in the young group in boys 6.5/1000 and in girls 5.8/1000. In the middle group the total incidence was 1.2/1000 for boys 1.6/1000 and for girls 0.8/1000. In the older group the total incidence was 0.3/1000 and in terms of sex, 0.3/1000 for boys and 0.2/1000 for girls. Taken by sex in the infant ($p = 0.081$), young ($p = 0.360$) and older ($p = 0.304$) age groups there was no statistically significant difference in the incidence of FC ($F = 3,780$, $F = 0,886$; $F = 1.175$ respectively). However, in the middle age group there was a statistically significantly greater incidence of FC ($F = 12.389$; $p = 0.006$) in boys in comparison with girls.

The highest incidence of FC (4.1/1000) was in 1999 and the lowest in 2002 and 2003, when it was only 2.4/1000. There was a slight rise (3.2/1000) again in 2004. The incidence of febrile convulsions in the examined population showed a decreasing trend which is not statistically significant ($y = 3.800 - 0.214x$; $p = 0.176$).

The trend of the incidence of FC in age groups in the population of boys and girls is shown in Figures 2 and 3.

If we consider the trend of the incidence of FC in the population of boys in age groups, the greatest fall is recorded in the infant age group, whilst in the older age group there is even a slight rise. However, none of these tendencies reaches statistical significance ($Y = 8.213 - 0.494x$; $p = 0.232$, and $Y = 0.220 + 0.023x$; $p = 0.684$).

In the population of girls, the greatest fall in the incidence of febrile convulsions was

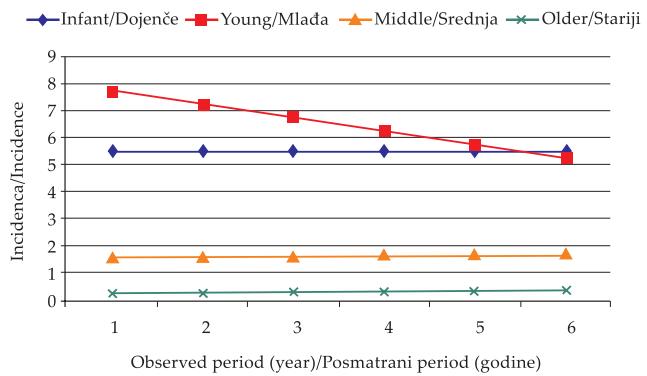


Figure 2 The trend of the incidence of febrile convulsions by age group in boys

Slika 2 Trend incidence febrilnih konvulzija u dječaka po dobnim grupama

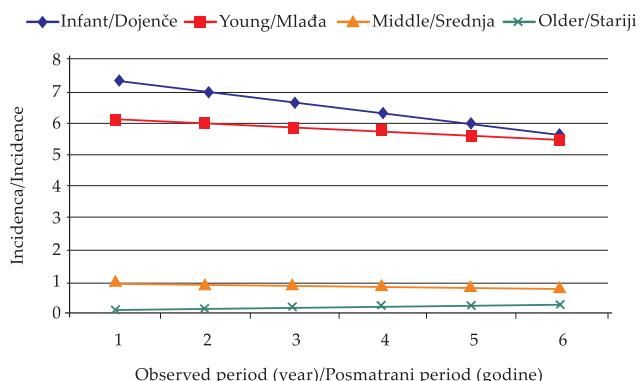


Figure 3 The Trend of the incidence of FC by age groups in girls

Slika 2 Trend incidence febrilnih konvulzija po dobnim grupama u djevojčica

in the infant age group, whilst in the older age group there is even a slight rise. However, here too, none of these tendencies attains statistical significance ($y = 7.967 - 0.357x$; $p = 0.334$).

The frequency of FC in terms of seasons of the year in relation to age groups is Table 2.

In total the difference between the seasons of the year in terms of the occurrence of FC is statistically significant (χ^2 test = 26.22918; DF = 3; P < 0.0001). The frequency of FC in total was greater in spring (27.2%) than in summer (23.6%) and autumn (19.0%), and less than in winter (30.2%).

Febrile convulsions of the simple type were found in 88.8% children and the complex type in 11.2% children. The frequency of FC by type of attack in boys and girls in age groups is shown in Table 3.

There were simple FCs in both sexes and all age groups. In total, in boys and girls the

Table 2 The incidence of febrile convulsions in age groups in relation to the season**Tabela 2** Incidencija febrilnih konvulzija u odnosu na dobne grupe i godišnje doba

| Age groups/ Dobne grupe | The incidence of febrile convulsions in relation to the season/ Incidenca febrilnih konvulzija u odnosu na godišnje doba | | | | Total/Ukupno n (%) |
|----------------------------|---|---------------------------|---------------------------|--------------------------|-----------------------|
| | Spring / Proljeće n (%) | Summer/ Ljeto n (%) | Autumn/ Jesen n (%) | Winter/ Zima n (%) | |
| Infant/ Dojenčka | 56 (28.7) | 46 (23.6) | 43 (22.1) | 50 (25.6) | 195 (100.0) |
| Young/ Mlađa | 114 (27.0) | 94 (22.5) | 80 (19.2) | 129 (31.0) | 417 (100.0) |
| Middle/ Srednja | 20 (23.2) | 24 (28.0) | 11 (12.8) | 31 (36.0) | 86 (100.0) |
| Older/ Starija | 5 (27.8) | 5 (27.8) | 2 (11.1) | 6 (33.3) | 18 (100.0) |
| Total /Ukupno | 195 (27.2) | 169 (23.6) | 136 (19.0) | 216 (30.2) | 716 (100.0) |

Table 3 The frequency of type of attack of febrile convulsions in boys and girls in age groups**Tabela 3** Ucestalost tipa napada febrilnih konvulzija u dječaka i djevojčica u odnosu na ispitivane grupe

| Age groups/ Dobne grupe | Boys | | | | Girls | | | | | |
|----------------------------|------------------------------|-------|---------------------------|-------|------------------------------|-------|---------------------------|-------|--|--|
| | Simple FC/ Jednostavne FK | | Complex FC/ Složene FK | | Simple FC/ Jednostavne FK | | Complex FC/ Složene FK | | | |
| | n | % | n | % | n | % | n | % | | |
| Infant/ Dojenčka | 74 | 21.7 | 16 | 34.8 | 89 | 30.2 | 16 | 47.0 | | |
| Young/ Mlađa | 207 | 60.7 | 21 | 45.6 | 177 | 60.0 | 12 | 35.3 | | |
| Middle/ Srednja | 49 | 14.4 | 9 | 19.6 | 22 | 7.4 | 6 | 17.7 | | |
| Older/ Starija | 11 | 3.2 | - | - | 7 | 2.4 | - | - | | |
| Total /Ukupno | 341 | 100.0 | 46 | 100.0 | 295 | 100.0 | 34 | 100.0 | | |

FC = Febrile convulsions/FK = Febrilne konvulzije

difference in distribution between simple, such as complex FC in terms of age groups was not statistically significant (χ^2 test = 5.99425; p = 0.0781).

Discussion

The total average annual incidence of FC in children aged from 1 month to 7 years in the Tuzla Canton (TC) in the period from 1.1.1999 to 31.12.2004 for both sexes was 3.0/1000 (95% CI 2.8-3.3). The results of our research are identical to the results for individual regions of neighbouring countries. In the Republic of Croatia in the Primorsko-goranska county, in a ten-year period from 1990 to 2000, the incidence of FC was 3/1000 in children up to 6 years (12) and in a ten-year epidemiological study from 1986 to 1995 in the central region of Serbia, the annual incidence of FC was also 3/1000 children aged from 6 months to 5 years (13). The fact that the results are identical of our research into the total incidence of FC and those in the neighbouring countries of Croatia and Serbia could be explained by belonging to a geographical area, similar social and economic conditions, but also a relatively similar paediatric health care system in the regions. However, our assumptions should be tested in future multi-centre studies.

In terms of age, in our research the total incidence of FC was the highest in the infant and young age groups, at 6.1/1000 and 6.2/1000. A more detailed study of the incidence in the infant group shows that the frequency of FC from 1 to 5 months was only 16.4% and from 6 to 12 months it increased to as much as 83.5%. The greatest incidence of FC between 6 months and 3 years is also mentioned by other authors in older and new retrospective and prospective studies (6, 13). This fact, regarding the significantly greater incidence of FC in that period of life, is still not understood, but it is linked with specific processes related to the maturation of the CNS (neural prolifera-

ration, migration of neurons, organization and myelination), and other factors which could cause the occurrence of FC (14). According to our results, an evident fall in the incidence of FC occurs after three years. It moves from 0.3/1000 for the older group to 1.2/1000 for the middle age group, which is also in line with other results (6, 15, 16).

Although our study found a slightly higher incidence of FC in boys, this was not statistically significantly higher, just as in other studies (6, 7), which indicates that the effect of gender on the occurrence of FC is not significant.

The largest total incidence of FC of 4.1/1000 was recorded in 1999 and the lowest in 2002 and 2003, when it was 2.4/1000. There was a slight rise again (3.2/1000) in 2004. However, the falling trend of the incidence of FC in this period, when taken in total, and in relation to age groups and separated for the sexes, was not statistically significant. During 1999 there was a higher occurrence of viral infections which had an epidemic character in the Tuzla Canton, which could be the reason for the higher incidence of FC in that period.

Febrile convulsions occur throughout the year, but the largest number of children with FC was recorded in the winter and spring. The greater incidence of FC was probably the result of frequent infections, especially of the respiratory tract, in these seasons. In terms of the type of attack, 88.8% of patients in all age groups had simple type FC, and 11.1% complex type. Other authors also state the greater frequency of simple than complex febrile convulsions.

Conclusion

The data presented in this study are the first epidemiological indicators of febrile convulsions in Bosnia and Herzegovina and form a new basis for further monitoring, since they may be useful in planning preventive, organizational and therapy programs of the paediatric health service of this region.

Conflict of Interest: The authors declare that they have no conflict of interest. This study was not sponsored by any external organisation.

Sukob interesa: autori su se izjasnili da nisu u sukobu interesa. Studija nije bila sponzorirana od neke vanjske institucije.

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