CLINICAL STUDY

Influence of geomedical factors on Guillain-Barré syndrome incidence in the region of Western Slovakia

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Abstract

During 5-years of follow-up we identified 58 cases of the Guillain-Barré syndrome in the Western Slovakia (approximately 1 300 000 inhabitants). The incidence of this disease fluctuated between 0.4-1.9 cases per 100 000 persons likewise mentioned in the literature. It was interesting to analyse the influence of bioclimatic conditions. We found that while higher altitude, cold and humidity increased the incidence of the GBS, warm weather had the opposite (beneficial) effect. This phenomenon might be related to a higher incidence of upper respiratory tract infections, which probably induce the autoimmune related disease. ***(Tab. 1, Fig. 4, Ref. 12.)***

Key words: Guillain - Barré syndrome, geomedical and bioclimatic factors, polyradiculoneuritis.

Although the clinical picture and the acute course of the peripheral nervous system lesion with typical CSF findings was already described in 1859 by Landry and in 1916 by Guillain, Barré and Strohl, the cause of this syndrome still remains unclear. The disease has been presented in text books under different names such as the Guillain--Barré syndrome (GBS), acute inflammatory polyneuropathy, acute autoimmune neuropathy, acute inflammatory demyelinating neuropathy (1, 2). Clinically it is an acute monophasic disease with a significant incidence of CSF globulinosis often accompanied with a light form of pleocytosis with a morphological picture of demyelination (especially segmental demyelination) and mononuclear infiltration. Although the ethiology is unknown, there is an analogy with experimental allergic neuritis (EAN) in which the autoimmune origin and the effect of the myelin basic protein P2 plays the main role in the pathogenesis (1, 2, 3). The viral etiology has not been proved yet. Clinically there is a significant difference between GBS and the chronic inflammatory demyelinating polyneuropathy (CIDP). The incidence of the GBS is 0.4—1.9 per 100 000 persons. The disease occurs more frequently in some regions, especially in the temperate zone. Information on the influence of environmental factors on the incidence of the GBS is still insufficient. We have already analysed the environmental factors that influence the incidence of the multiple sclerosis (MS) in Western Slovakia (4). We decided to investigate the relation between the GBS incidence and the geomedical factors influence.

Material and methods

We have examined the incidence of GBS for five years in the territory of Western Slovakia with approximately 1 300 000 inhabitants. We can divide the whole area into two characteristic parts -- the dry and warm part (A1, A3, A5), the part with high altitude and humid climate (B3, B5, B8) and part with altitude higher than 800 m above the sea level (C1) (Fig. 1). All cases were diagnosed according to the international criteria so that the percentage of undetected cases was minimal. During 5 years we detected 58 cases. We analysed the influence of different bioclimatic factors (ΣT10, temperature, sunshine, fog, altitude, humidity, index of irrigation) according to the data from the National Hydrometerologic Institute (5). We correlated the bioclimatic factor influence with the multifactorial analysis which considered the importance of the variables with the incidence of the disease. The results were examined with the t-test and chi-square test.

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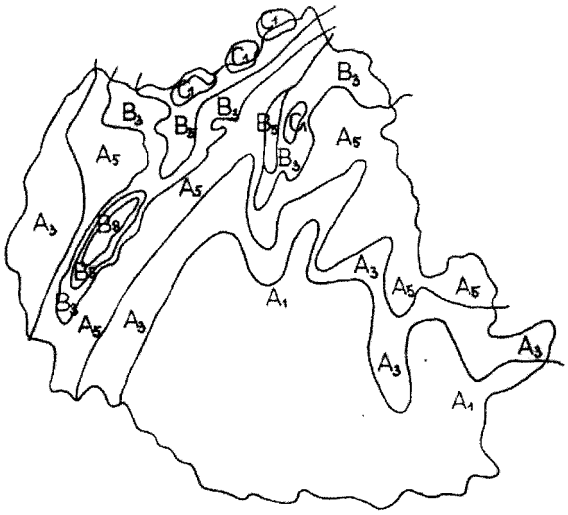

Fig. 1. Climatic region in the investigated region. A — warm region (>50 summer (warm) days yearly), B — moderately warm region (<50 summer days yearly, mean temperature in July >16 °C), C — cool region (<50 summer days yearly, mean temperature in July <16 °C). Climatic region: A_1 — dry, warm with mild winter and long hours of sunshine, A_3— warm, moderately dry with mild winter, A_5 — warm, moderately humid with mild winter (localized in slopes up to 300-400 m), B_3 — moderately warm and humid, hilly character, B_5 — moderately warm and humid, altitude higher than B_3, B_8 — humid, altitude higher than B_5, C_1 — moderately cool, altitude above 800 m.

Results

According to the literature the influence of humidity and cold might be a provoking factor in the Guillain—Barré syndrome. The occurrence of the disease differed according to periods of cold and warm months per year. The incidence reached the highest point in December, but the total number of cases occurring in these colder periods was not significant (Fig. 2).

Tab. 1. Incidence of polyradiculoneuritis (in absolute number of cases per 5 years and number of cases per 100 000 inhabitants per year) in investigated territory in relation to ΣT10 (summary of day temperatures ≥10 °C per year).

≥T °C	Polyradiculoneuritis		Population
	No of cases	%	
≥3000	24	*1,367 σ = ± 0,0027	365 680
>3000	34	0,777 σ = ± 0,0013	900 494

*p<0,05

We followed the frequency of the incidence in correlation with the regional structural and the influence of environmental agents by using the factor ΣT10 (summary of the day temperatures per year warmer than 10 °C) and we divided the area into part with higher and lower ΣT10. In the part with a small number of warm days (ΣT10 less than 3000 °C) we found a significantly higher incidence of the GBS in the hilly, less warm and more humid part of the region (Fig. 3, Tab. 1).

This finding led us to a multifactorial analysis of other indices of bioclimatic factors.

By following different variables we found that the temperature and a higher amount of warm days per year (ΣT10) exhibited a beneficial influence on the GBS incidence while fog, higher altitude, humidity, higher index of irrigation, and absence of sunshine had a negative effect (Fig. 4).

Discussion

The pathogenesis of the Guillain—Barré syndrome remains unclear although various theories have already been considered such as the autoimmune or the viral theory (1, 2, 6). Brostoff and Eylar (1972) found that the presence of the myelin basic protein

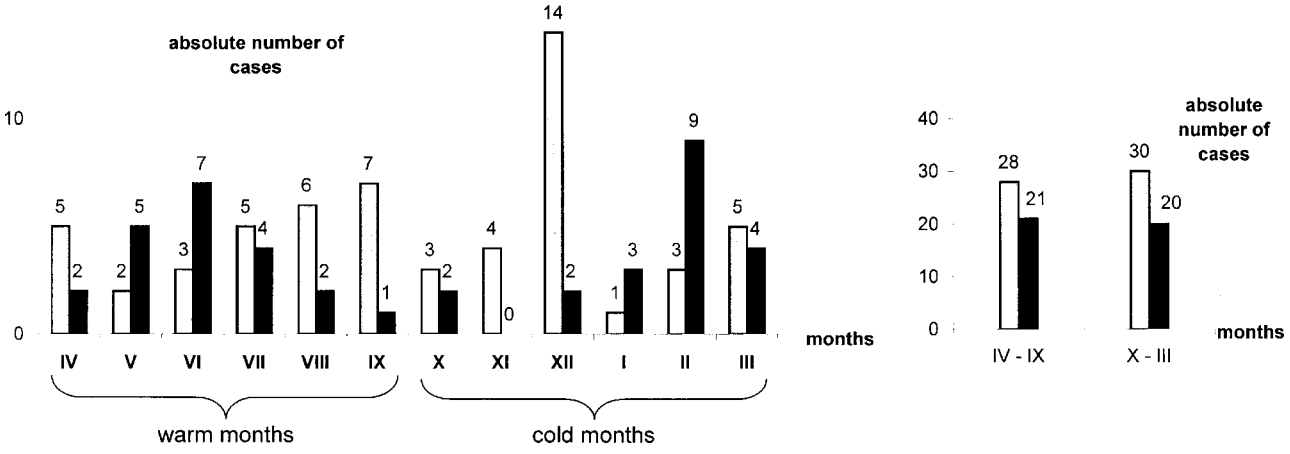

Fig. 2. Incidence of polyradiculoneuritis in several months and in the warmer and the colder half of the year (comparison of the present findings with the data of Melnick (1964) in the dark columns).

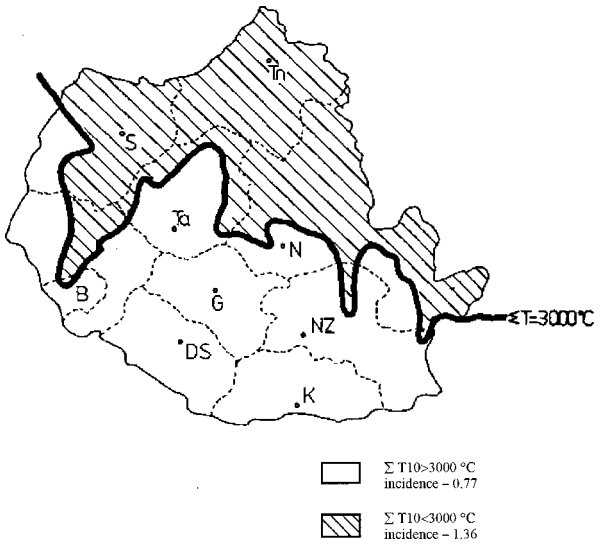

Fig. 3. Incidence of the polyradiculoneuritis in the territory of Western Slovakia in relation with ΣT10 (ΣT10 = year summary of day temperatures ≥10 °C).

P 2 as a factor of the autoimmune related inflammation may play a role in the pathogenesis of the EAN (3). The monophasic and acute disease has its clinical alternative in chronic inflammatory demyelinating polyneuropathy, which has a chronic or subacute course with a possibility of relapse or remission as in multiple sclerosis. CIDP as well as MS occur more frequently in patients with HLA-A1, HLA-B8, HLA-DRW3, HLA-DW3 (2). The role of the genetic factors in the investigated territory in the etiology of the GBS cannot therefore be excluded. We have to mention other possible triggering or facilitating agents in the autoimmune-related reaction. A particularly higher coincidence of the GBS and the upper respiratory tract infections (7, 8). There is also a question of the influence of the cold weather. However, neither Melnick's (1963) nor our findings have confirmed this theory (9, 10). Nevertheless Aguayo et al (1977) points to the possible development of the polyradiculoneuritis owing to the direct impact of cold under experimental conditions (11). Schaltenbrandt and Bammer (1966) found that the polyradiculoneuritis exhibited the highest incidence in 1929, an extremely cold year (-23 °C in Wurstenberg and -20 °C in Hamburg). In these (for the Middle Europe extreme low temperatures) it was probably the cold which had a direct effect on these cases (12). A seasonal predisposition for the development of the GBS during 1945—1958, was observed. The incidence was higher in February, March and November, that means in months which are more humid than cold. Wiederholter et al (1964) found only a moderately lower incidence of the GBS in summer and autumn without a significant seasonal predisposition (7). Although we investigated a relatively small region with a varied climate, we found a higher incidence of the GBS in the areas with higher altitude, and a colder and more humid environment. Estrada (1977) noticed a high incidence of the polyradiculoneuritis in subtropical Cuba where he postulated the role of upper respiratory tract infections in the humid climatic conditions. Finally we would like to point out that the humid climate is a facilitating factor for the development of the polyradiculoneuritis. The dry and warm climate decreases the incidence of the GBS. There is a certain bioclimatic similarity between the incidence of the MS and the GBS. This fact does not overthrow the theory of the autoimmune reaction with a possible genetic — related component.

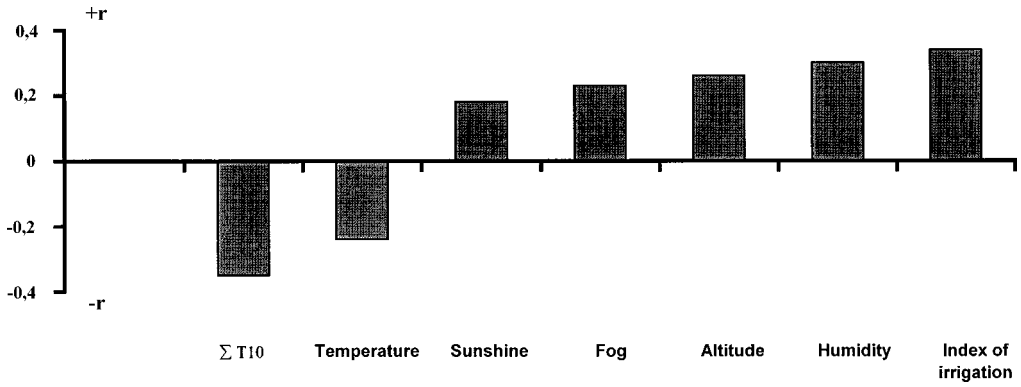

Fig. 4. Influence of different climatic factors as importance of variables in polyradiculoneuritis in Western Slovakia.

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