Coll. Antropol. **29** (2005) 1: 309–313
UDC 617.731-002:613.16
Original scientific paper

Epidemiology of Monosymptomatic Optic Neuritis in Rijeka County, Croatia: Meteorological Aspects

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A B S T R A C T

In order to analyze the meteorological factors possibly influencing the monosymptomatic optic neuritis in Rijeka County, northwestern part of Croatia, retrospective analysis of all cases diagnosed in Rijeka County in period from 1977 to 2001, was done. Meteorological data on monthly and yearly temperature, humidity, insolation in Rijeka County were collected from Croatian Meteorological and Hydrological Service. In the observed period there were 173 cases of monosymptomatic optic neuritis, female/male ratio was 1.66, and overall incidence was 2.18/100,000 inhabitants. There was no correlation of incidence with average yearly and monthly temperature, humidity, insolation, or month of birth. This is the first study on meteorological factors and optic neuritis in Croatia.

***Key words**: optic neuritis, meteorological factors, croatia*

Introduction

Monosymptomatic optic neuritis could be assumed as a *forme fruste* of multiple sclerosis[1]. Both entities express different characteristics and incidence in different populations and regions. Whites of northern extraction are most susceptible; whites of Mediterranean extraction are moderately susceptible; and African blacks and Asians are hardly susceptible at all[2]. As the etiology of multiple sclerosis is still indistinct, better understanding of environmental factors possibly influencing the MON may be a clue for better understanding of multiple sclerosis.

Therefore, in order to obtain information on MON epidemiology and climatology in Rijeka County, northwestern part of Croatia, in period between 1977 and 2001, retrospective analysis of all cases diagnosed at the Department of Ophthalmology, University Hospital Center Rijeka was done. The results will be discussed in comparison with findings made in other countries.

Subjects and Methods

All cases of monosymptomatic unilateral optic neuritis diagnosed in region of Rijeka during the period of 1977–2001 were reviewed. Official clinical guideline requires that all cases with optic neuritis have to be hospitalized. Inclusion criteria for neuritis were: acute symptoms indicative of unilateral optic neuritis of unknown or demyelinating origin, visual symptoms of 14-day duration or less, relative afferent pupillary defect in affected eye, and normal or swollen optic disc of affected eye[3]. Unilateral retrobulbar optic neuritis and papillitis were pooled together, as they are both part of the MS spectrum and not differ from each other with regard to clinical and paraclinical parameters[4,5]. Only patients inhabitating the region of Rijeka were included. Data regarding place of residence, sex, age, day of birth, onset of MON, are reported for each patient. Meteorological data on average yearly and monthly temperature, humidity and insolation in region of Rijeka for period

Received for publication January 9, 2004

1977–2001 were collected from Croatian Meteorological and Hydrological Service. No data for insolation for years 1992, 1997, 1998 were available. Vital statistics records were obtained from the Institute of Public Health in Rijeka[6].

Descriptive statistics, simple linear correlation, and chi-square test were done with software package STATISTICA 6.0 (StatSoft, Inc., Tulsa, USA). The statistically significant difference in the test was set at $p \leq 0.05$ level.

Results

In total, 173 cases (108 females and 65 males) of monosymptomatic optic neuritis occurred during the studied period of 25 years. Average age of onset was 37±13 years for all cases, 37±12 years for females, 36±13 years for males. The cases were distributed between 10 and 69 years of age. Incidence increased from the youngest age group (10–14 years, 3/173 cases) to group 25–29 years (age group with peak incidence, 28/173 cases) and rapidly decreased after age 50–54 (16/173 cases). Distribution according to age of onset showed bimodal curve, as the highest incidence was in age groups 25–29 (28/173 cases) and 45–49 (25/173 cases) years.

Table 1 shows distribution of incidence during 25 years. Incidence increased continuously from 1977 to 1987, when it rapidly decreased and stayed steady until 2001. However, this notchy distribution did not have any statistic significance (χ^2=31.14, p=0.15).

The considerable number of births occurred in 1945–1959 (71 cases, 41%), as represented in Table 2.

TABLE 1
INCIDENCE OF MONOSYMPTOMATIC OPTIC NEURITIS DURING 25 YEARS

Year	Population	Incidence		
		Females	Males	All
1977	283813	0.35	0.00	0.35
1978	289370	0.00	1.73	1.73
1979	293405	0.68	1.70	2.39
1980	298140	0.34	1.34	1.68
1981	297075	1.35	0.67	2.02
1982	299953	1.33	1.00	2.33
1983	310466	1.29	1.29	2.58
1984	313175	1.28	1.92	3.19
1985	316848	1.58	1.89	3.47
1986	320045	2.19	1.56	3.75
1987	322935	3.41	1.24	4.64
1988	325418	0.92	0.61	1.54
1989	328088	2.44	0.00	2.44
1990	323902	1.54	0.00	1.54
1991	323130	1.55	0.31	1.86
1992	322860	0.31	0.62	0.93
1993	327524	1.83	0.61	2.44
1994	330961	0.30	0.91	1.21
1995	334990	0.90	0.00	0.90
1996	339527	1.47	0.59	2.06
1997	343563	2.04	0.00	2.04
1998	345775	2.02	0.29	2.31
1999	347235	1.44	0.29	1.73
2000	304410	1.64	1.31	2.96
2001	305695	1.31	0.98	2.29
Average		1,36	0.82	2.18

TABLE 2
YEAR OF BIRTH FOR 173 CASES OF MONOSYMPTOMATIC OPTIC NEURITIS

Year of birth	Females	Males	Total
1910–1914	0	2	2
1920–1924	2	3	5
1925–1929	2	1	3
1930–1934	8	3	11
1935–1939	7	7	14
1940–1944	11	5	16
1945–1949	11	11	22
1950–1954	16	8	24
1955–1959	15	10	25
1960–1964	11	3	14
1965–1969	9	3	12
1970–1974	8	4	12
1975–1979	6	2	8
1980–1984	2	3	5
Total	108	65	173

Seasonal distribution (Table 3) expressed the biphasic curve. The highest incidence was in months March-May and the smaller peak of incidence was observed during December–January. Correlation between meteorological factors and monthly proportion of MON cases were as follows: monthly temperature, r=–0.203, p=0.42; monthly humidity, r=–0.005, p=0.99; monthly sunny hours r=–0.103, p=0.75. Correlation between meteorological factors and yearly proportion of MON were as follows: yearly temperature, r=–0.203, p=0.37; yearly humidity, r=0.317, p=0.15; yearly sunny hours, r=0.228, p=0.31 (Table 4). There was no statistically significant correlation between proportion of MON cases and any meteorological factor. There was no significance of month of birth (χ^2=19.07, p=0.06).

Discussion

This study showed that MON in Rijeka County expressed the biphasic curve, with the highest incidence in months March–May and the smaller peak of inci-

TABLE 3
METEOROLOGICAL DATA AND OCCURRENCE OF MONOSYMPTOMATIC OPTIC NEURITIS (MON) – MONTHLY DISTRIBUTION

Month	Temperature (°C)	Humidity (%)	Monthly sunny hours	MON cases occurred	MON cases born
January	5.9	65.3	112.1	14	15
February	6.3	60.3	133.9	11	18
March	9	61.5	154.2	20	15
April	12	62.5	173.8	22	23
May	16.9	63.3	230.1	19	15
June	20.2	62.1	251.5	16	16
July	23.2	56.4	299.6	12	12
August	23.2	55.8	278.0	13	12
September	18.8	64.2	199.1	5	18
October	14.5	68.4	161.4	12	15
November	9.6	67.1	111.6	9	12
December	6.8	65.8	101.7	20	2

dence during December–January. There was no statistically significant correlation between proportions of MON cases and any meteorological factor or month of birth.

This study has certain limitations, which are common for all retrospective studies. However, this is the first report on meteorological conditions and MON in Croatia.

Our results were compared to those in other epidemiological studies on MON in Table 5. There was dissimilarity in age group with peak incidence for both sexes in different studies, but these differences were, to a great extent, methodological, as approved by Jin et al.[17]. Confirming the studies of other authors, we found that MON mostly affects females[9–11,14,17]. Female preponderance indicates the possible genetic basis of MON[19].

As suggested by Jin et al.[19], bimodal distribution of MON incidences by age and year of birth of cases of MON may suggest that environmental causal factors differentially affected birth cohorts at an approximately 6–7 year cycle. Incidence of MON increased continuously from 1977 to 1987 when 15 cases occurred, after that it rapidly decreased and stayed steady until the last year of study. Having small sample, it is difficult to interpret if this finding could be assigned to methodological reasons, environmental causal factors, or some other reason[20].

The only previous study on the month of birth for MON cases by Jin et al.[17] reported the greater number of births in February, April, July and September. However, the comparison between both samples must be restrained by the rather small sample size, which constitutes limitations for an incidence study. In a large-scale study of more than 6000 patients with multiple sclerosis in Denmark the birth occurred mainly in March through June[21]. Similar results were found in the study by Sadovnick and Yee on 2229 patients in British Colum-

TABLE 4
METEOROLOGICAL DATA AND OCCURRENCE OF MONOSYMPTOMATIC OPTIC NEURITIS – DISTRIBUTION OVER 25 YEARS

Year	Temperature (°C)	Humidity (%)	Yearly sunny hours	N of cases (Total=173)
1977	13.8	66	2083.4	1
1978	12.9	64	2046.9	5
1979	13.7	60	2134.7	7
1980	12.7	62	1872.0	5
1981	13.4	62	2132.4	6
1982	14.1	61	2237.4	7
1983	13.7	62	2279.1	8
1984	13.0	64	2001.1	10
1985	13.4	60	2226.9	11
1986	13.5	57	2362.4	12
1987	13.4	63	2237.5	15
1988	14.0	62	2246.4	5
1989	13.9	63	2312.9	8
1990	14.3	62	2382.0	5
1991	13.6	58	2306.1	6
1992	14.5	60	–	3
1993	13.9	60	2278.3	8
1994	15.0	61	2336.9	4
1995	13.6	67	2190.4	3
1996	13.3	66	2141.0	7
1997	14.0	65	–	7
1998	14.2	63	–	8
1999	14.5	65	2154.4	6
2000	15.3	64	2401.8	9
2001	14.8	64	2234.4	7
Average	13.9	62	2209.0	6.9

TABLE 5
REVIEW OF EPIDEMIOLOGICAL SURVEYS ON MONOSYMPTOMATIC OPTIC NEURITIS

Place and study period	Span (years)	N of cases	Ratio F/M	Crude incidence	Age group with peak incidence
Olmsted county, USA 1935–1991[7]	56	156	2.18	5.15	40–45 (F) 40–45 (M)
Rochester, Minn, USA 1935–1964[8]	29	30	2.00	2.8	20–29
Hawaii, USA 1961–1971[9]	10	39	–/–	0.7	–
Uusimaa, Finland 1970–1978[10]	8	214	2.29	2.4	30–39 (F) 40–49 (M)
Vaasa, Finland 1970–1978[10]	8	82	1.73	2.3	20–29 (F) 30–39 (M)
Finland 1967–1971[11]	4	221	1.73	0.94	20–29
Israel 1955–1964[12]		85	1.74	0.56	–
Two counties, Norway 1972–1984[13]	12	41	0.95	1.40	–
Hannover, Germany 1976–1977[14]	1	30	2.00	2.69	21–44
Carlisle, UK 1955–1961[15]	6	8	–/–	1.60	–
Sardinia, Italy 1977–1986[16]	9	80	1.86	2.40	–
Stockholm county, Sweden 1990–1995[17]	5	147	4.07	1.46	30–34 (F) 20–24 (M)
Japan 1992–1993[18]	1	550	1.11	1.62	–
Rijeka county, Croatia 1977–2001	24	173	1.66	2.18	25–29 (F) 30–39 (M)

bia[22]. Our results did not support any relation of month of birth and incidence of MON.

We observed no significant correlation between temperature, insolation, humidity and incidence of MON. On the other hand, similar study in Stockholm County[19] reported the significant correlations of MON and sunny hours and temperature. Sanchez et al.[23] also suggest that environmental factors could modify the clinical expression of multiple sclerosis. The absence of correlation in our study could be addressed to relatively small yearly variations in meteorological factors typical for Mediterranean climate, when comparing to great variations in Stockholm.

Numerous studies confirmed seasonal distribution of MON, as for many other diseases[24]. This finding could be explained by exogenous factor, i.e. virus, as evidence to date suggests that multiple sclerosis is caused by viral infection triggering autoimmune attack against nerve cells in genetically-susceptible individuals[25,26], as suspected for some other diseases previously assumed as noninfective[27]. Conversely, seasonal distribution could be assigned to changed susceptibility to the viral disease, which could be influenced or driven by some biorhythm. As etiology of MON and multiple sclerosis is still unclear, epidemiological data and analysis of environmental influences could give substantial information, and possible modalities of supportive climatotherapy.

Our further investigations will be directed to detecting the proportions of cases of MON that converted to multiple sclerosis, as some studies revealed that the proportions were higher among cases with MON onset in January through March[28].

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EPIDEMIOLOGIJA MONOSIMPTOMATSKOG OPTIČKOG NEURITISA U RIJEČKOJ ŽUPANIJI, HRVATSKA – UTJECAJ METEOROLOŠKIH UVJETA

S A Ž E T A K

Retrospektivno su analizirani svi slučajevi monosimptomatskog optičkog neuritisa dijagnosticirani u Riječkoj županiji (sjeverozapadni dio Hrvatske), koji su dijagnosticirani u razdoblju od 1977. do 2001. godine, kako bi se analizirali mogući meteorološki utjecaji na pojavu ove bolesti. Meteorološki podaci o prosječnoj godišnjoj i mjesečnoj vlažnosti zraka, temperaturi i broju sunčanih sati u Riječkoj županiji dobiveni su od Državnog hidro-meteorološkog zavoda. U ispitanom razdoblju otkrivena su 173 slučaja monosimptomatskog optičkog neuritisa, spolni omjer bio je 1,66 u korist žena, a prosječna incidencija 2,18/100.000 stanovnika. Nije nađena nikakva statistički značajna korelacija između pojave monosimptomatskog optičkog neuritisa i ispitivanih meteoroloških čimbenika, kao ni korelacija s mjesecom rođenja oboljelih. Ovo je prvo istraživanje veze meteoroloških čimbenika i optičkog neuritisa u Hrvatskoj.