Multiple Sclerosis and Mines: An Epidemiologic Study from Kerman Province, Iran

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ABSTRACT

Background and Purpose: Multiple sclerosis (MS) is a disease determined by the interaction of genetic and environmental factors. Metals are suspected of being involved in MS. There is not any epidemiologic study about mines and MS. The purpose of this study was to determine MS prevalence according to mines in Kerman province.

Methods: This cross-sectional study was conducted on 932 patients in Kerman province in 2012. The details of the patients including age, sex, age at the onset of disorder and disease duration were collected from documents of MS centres of Kerman and Rafsanjan Universities of Medical Science. Diagnosis was confirmed according to the revised Mc-Donald criteria. To analyze the data, SPSS-17 software and descriptive statistics and t-test were used

Results: The male/ female ratio was 1:3. The prevalence of MS in Kerman province was 31.7 per 100000. Kerman, Sirjan, Zarand and Rafsanjan had the highest prevalence of MS, respectively. The mean prevalence of MS in mineral areas in Kerman province (Kahnoj, Sirjan, Zarand, Rafsanjan, Baft, Shahrbabak) was 23.01±10.78 and in non-mineral areas (Kerman, Bam, Jiroft) was 39.56±20.34 that show the higher prevalence of MS in non-mineral areas of Kerman province.

Conclusion: Our findings showed that prevalence of MS is lower in mineral areas and probably, living in these areas isn't a predisposing factor for MS.

Keywords: Prevalence; Multiple Sclerosis; Mines.

INTRODUCTION

Multiple sclerosis (MS) is the most common inflammatory-demyelinating disease of the central nervous system and also, the most frequent cause of non-traumatic neurologic disability in young and middle-age adults [1]. Our knowledge about its pathogenesis is still incomplete and etiology remains unknown, but according to current data the disease develops in genetically susceptible individuals and may require additional environmental triggers [2]. Probably, the immune process is a consequence of the connections between environment and susceptibility genes [3]. Infective disease, dietary, habits (such as smoking), industrial exposure, and living in ecological hazard areas could be considered environmental factors [4,5]. Early observations showed that the prevalence of MS is variable among geographic areas but we still don't have any confirmed data about the nature of these pathologic factors in ecological hazard areas [6]. One of the most geographic differences among areas of the world is mines existence. Also, available articles provide evidences of the effect of metals in MS pathogenesis [7-9]. For example, iron [10], selenium [11],

copper [12], calcium [13], lead [3], aluminium [14] are only a small part of a big list of metals that have introduced in MS pathogenesis. Not only researches in the other countries but also some studies in Iran have confirmed an imbalance in serum and CSF level of trace elements in MS patients [12,15-17]. According to our review in many medical resources including Pubmed, there isn't any published epidemiologic study about prevalence of MS related to mines. Because Kerman province is a vest state with several important and different mines, we decided to do this research in this area. Our project is the first pilot study in this field and helps to identify the effect of environmental factors on MS pathogenesis.

PATIENTS AND METHODS

Our study was conducted in Kerman province. It covers an area of 181,714 km^2 and includes 11% of the total area of the country. It is located in the south-eastern part of the country bounded by the provinces of Hormozgan in the south, Yazd and South Khorasan in the north, Fars in the west and the provinces of Sistan and Balochestan in the east. The main townships of Kerman province are; Baft, Bam, Jiroft, Rafsanjan, Zarand, Sirjan, Shahrbabak, Kahnoj and Kerman. The main mines in province of Kerman are iron, cooper, chrome and titanium. The province has a population of approximately 3 millions according to the national census in 2011 [18].

Data collection

This cross-sectional study was conducted on 932 patients in 2012. All of them were known cases of MS and resident in Kerman province. The disease data were collected from documents of MS centres of Kerman and Rafsanjan Universities of Medical Science [19]. They were all diagnosed with MS by a neurologist and the MS committees (including at least 3 neurologists) in Kerman and Rafsanjan Universities of Medical Science had confirmed the diagnosis according to the revised Mc-Donald criteria 2010 [20]. The details of the patients including age, sex, age at the onset of disorder and disease duration were extracted from the records. The study was approved by the Neurology Research Centre of Kerman University of Medical Sciences.

Statistical analyses

Prevalence was defined as the total number of patients with a diagnosis of MS per 100,000 inhabitants. To analyze the data, SPSS-17 software and descriptive statistics (mean, frequency percent, and standard deviation) and t-test were used and $p \leq 0.05$ was considered statistically significant.

RESULTS

In the present study, 932 patients were evaluated. The male/female ratio was 1:3. The mean age of male and female were 38.1±9.72 and 36.12±9.97, respectively. Mean age at the onset of disease was 28.35 years (29±8.73 for men and 28±8.3 for women) (P<0.05). Also, the mean duration of illness was 8.2±1 year (8.4±1.2 for men and 8.7±0.5 for women) (P=0.30). The prevalence of MS in Kerman province was 31.7 per 100000. Kerman, Srjan, Zarand and Rafsanjan had the highest prevalence of MS respectively (Table 1). The mean prevalence of MS in mineral areas in Kerman province (Kahnoj, Sirjan, Zarand, Rafsanjan, Baft, Shahrbabak) was 23.01±10.78 and in non-mineral areas (Kerman, Bam, Jiroft) was 39.56±20.34 that show the higher prevalence of MS in non mineral areas of Kerman province. In addition, the highest prevalence of MS was seen in the areas that had chrome, iron and cooper mines, respectively (Table 2).

CONCLUSION

Our study evaluated the prevalence of MS according to mines in Kerman province. Our findings show that the prevalence of MS is higher in non mineral areas in comparison mineral areas. In addition, our study showed that the prevalence of MS in all kind of mines is lower than mean prevalence of MS in non-mineral areas (Table 1,2). We have not find any similar articles in literature review to compare our results with them It seems that our research is the first in this field. According our findings, we think that living in mineral areas is not a predisposing factor for

Table 1. Prevalence of MS in Kerman province and main townships.

Area	Mine	Prevalence
Kerman	Non	57.3
Baft	Chrome	31
Shahrbabak	Cooper	13.1
Rafsanjan	Cooper	27.1
Sirjan	Iron	31.8
Zarand	Iron	27.2
Bam	Non	17.5
Jiroft	Non	14.2
Kahnoj	Titanium	1.9
Kerman province		31.7

Table 2. Prevalence of MS according to mines in townships of Kerman province.

Mine	Township	Prevalence
Iron	Sirjan, Zarand	29.6
Cooper	Rafsanjan, Shahrbabak	22.5
Chrome	Baft	31
Titanium	Kahnoj	1.9
Non	Kerman, Bam, Jiroft	39.5

MS genesis and we should search for other environmental factors in MS etiology. However, we are confronted with the following facts about trace elements. First, available literature provides evidences of abnormal level of trace elements in clinically definite MS and also clinically isolated syndrome [21-24]. These studies are done on serum, cerebrospinal fluid, urine and hair [7,10,25-27] and including metals such as magnesium [28], iron [10], mercury [29], selenium [11], copper [12,30], calcium [13], zinc, chrome, lead, titanium [3,30], aluminum and many others [14]. Second, in MS animal models, some metals (such as copper) have been seen to attenuate experimental autoimmune encephalomyelitis, this fact would suggest a role of metals in MS initiation and progression [31]. Third, some studies showed a gradual accumulation of some metals (for example iron) in MS patients' brain especially in oligodendrocytes [32,33]. Since the main role of oligodendrocyte is myelin production and the myelin sheath of neurons are damaged in this disease, probably an imbalance of metals may lead to brain tissue inflammation and eventually to MS disease [25,28,34]. Forth, some metals (such as zinc, and mercury) are involved in autoimmunity response such as cytokine production, and we know that inflammation is a main picture of MS [29,35]. Also, trace elements are crucial for the development of the nervous system, myelination of the nerve fibers, and neuronal excitability. The ability of metals to promote neuronal damage and neurological dysfunction has been linked to their role in catalyzing the formation of superoxide anion ($O_2^{.-}$), singlet oxygen ($^1O_2$) and hydrogen peroxide H_2O_2, which, in turn, are important mediators of oxidative reactions of biological macromolecules involved in neurodegenerative processes [27-36]. According to these facts (that show the effects of minerals on MS) and our finding (that show the low prevalence of MS in mineral areas) we hypothesize that the nature of these metal abnormalities is related to MS pathogenesis than environmental effect.

It should be noted that our study was a pilot epidemiologic study and the results should be evaluated with caution. Still it is unclear metal interactions are a primary or secondary factor, or a consequence of the neurodegeneration and further studies in this field are needed. Lack of evaluation of place of birth and migration were our study limitations and should be corrected in further studies. In conclusion, our findings showed that prevalence of MS is lower in mineral areas and probably, living in these areas isn't a predisposing factor for MS.

ACKNOWLEDGMENTS

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