

Toxocariasis and multiple sclerosis: A case-control study in Iran

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Abstract

Human toxocariasis is a zoonotic infection caused by the larval stage of *Toxocara* species. A relationship between toxocariasis and multiple sclerosis has been hypothesized. In this study, we aimed at investigating the frequency of *Toxocara* infection among multiple sclerosis patients and the epidemiological factors associated with disease. Sixty-eight patients with multiple sclerosis and 70 healthy subjects were studied. Anti-*Toxocara* antibodies status was determined in all serum samples, using ELISA technique. The frequency of *Toxocara* infection was found to be significantly higher in multiple sclerosis patients as compared to the healthy control (14.7%, 1.4%, respectively) ($P=0.004$). There was no significant difference between multiple sclerosis patients and control group in age, education, and gender ($P>0.05$). This study indicates that a significant association between *Toxocara* seropositivity and multiple sclerosis. Our finding suggests that toxocariasis infection may increase the risk of multiple sclerosis.

INTRODUCTION

Human toxocariasis is widespread, zoonotic parasitic disease caused by the larval stages of either *Toxocara canis* or *Toxocara cati*. Dogs and cats are the definitive hosts and act as reservoir. Humans are infected by ingestion of embryonated eggs present in the soil or on contaminated hands and fomites.¹ The larvae hatch and migrate out of the intestine to become lodged in organs and tissue. The persistence of encysted larvae in human host tissues can cause clinical symptoms, depending on the number and location of the larvae in the body and the sensitivity of the host immune system.²

Multiple sclerosis (MS) is a chronic and inflammatory autoimmune disease of the central nervous system. Its aetiology remains obscure and subject to extensive research.³ Although some studies have shown an association between contact with dog or cat and MS, the role of this contact in the aetiology of the disease is still unknown.⁴ In previous study, it was shown that the prevalence of MS was correlated with a childhood environment characterized by a high level of sanitation.⁵ Similar findings have led to the formulation of hygiene hypothesis, which holds that a relative lack of “evolutionarily childhood” infectious exposures may predispose susceptible individuals to allergic and autoimmune diseases later life. It has been

showed that lifestyle and some residential factors may influence the development of MS. Increased risks were seen in the people exposed to soil, or exposed to animals.⁶

The literature about *Toxocara* suggests that it could play an initial role in the diseases process, together with other environmental factors such as stressful life events in combination with immunological factors and individual susceptibility.⁴ In the present study, our aim was to investigate toxocariasis among the multiple sclerosis patients and the epidemiological factors associated with the infection and compare them with a healthy population in Iran.

METHODS

Subjects

This study was conducted on 68 patients (42 women and 26 men) with MS aged between 3-49 years (mean 32.9 ± 11.6 years) who were followed up in the Neurology Division of Shohadaye Ashayer Hospital in 2013. These patients had evaluation of their clinical history, cranial imaging such as Computed Tomography (CT) scans or Magnetic Resonance Imaging (MRI). The diseases were defined accordingly to the McDonald Criteria.⁷

Control population

The control group consisted of 29 male and 41 female volunteers aged between 3-52 years (mean 30.9 ± 12.1 years) with comparable epidemiological characteristics and without any complaints or history of previous neurological complications in either themselves or their families. The demographic and lifestyle characteristics were obtained by survey questionnaire.

Ethical consideration

Informed consent was obtained from all participants. The study design, including its ethical aspects, was reviewed and approved by the Ethics Committee of Lorestan University of Medical Sciences.

Serological evaluation

Three mL venous blood was taken under sterile conditions from each subject in the both group and the sera of these blood samples were separated by centrifuge at 2500 rpm, aliquot, and store at -20°C until analyses were carried out. Anti-*Toxocara* antibodies were detected by commercial Enzyme-Linked Immunosorbent Assay (ELISA) kit (IBL, International GmbH, Hamburg, Germany) following the manufacture's instruction.

Statistical analysis

Statistical evaluations were performed with SPSS version 15.0 of windows 2003. All epidemiological, clinical and laboratory information were tested for their association between with toxocariasis. Chi-square test and Fisher's exact test were used for categorical data. A *P*-value that is less than 0.05 was considered statistically significant.

RESULTS

Out of 68 patients who participated in the study, 10 (14.7%) had positive anti-*Toxocara* antibodies, as compared to 1 (1.4%) among control group. This was statistically significant ($P=0.004$) as

shown in Table 1.

There was no significant difference between MS patients and control in terms man age, age group, and gender. On the other hand, there were more housekeepers among the MS patients, whereas there were more workers among the control group (Table 2). There was predominance of rural compared to urban population among our seropositive patients. Of the 10 (14.7%) seropositive patients, there were 7 (70.0%) from the rural area, and 3 (30.0%) from the urban area which was statistically significant ($P=0.001$). There was significantly higher proportion of farmers among the seropositive subjects ($P=0.047$).

DISCUSSION

Multiple sclerosis is a disease with unknown aetiology. The finding of monoclonal antibodies in MS patients has been attributed to various infections agents. Some epidemiological studies have found an association between exposure to stress and household pets prior to the diagnosis of MS.⁴ There were only few reports of previous studies to investigate the relationship between toxocariasis and MS. In a relatively similar study, Kuk *et al*³ investigated the association between *Toxocara* infection and MS patients. They found that the seropositivity rate of *Toxocara* infection in MS patients is higher than the ones in control group. They emphasized that the causative relationship between the disease and the infection was unclear. In this study, the frequency of *Toxocara* infection in MS patients was 14.7%, significantly higher than the healthy control (1.40%). However, as the reported prevalence of toxocariasis in the general population in Iran ranged 2 to 25.6%, the relatively low frequency of *Toxocara* infection in our control group required cautious interpretation.

Of the 10 MS patients seropositive to *Toxocara*, 7 (70.0%) were female. However, this was not higher than the overall proportion of the female patients (61.8%). Toxocariasis is seen more

Table 1: Seroprevalence of antibodies to *Toxocara canis* in the multiple sclerosis patients and control group

	Multiple sclerosis patients		Control group		Total	P-value
	No.	(%)	No.	(%)		
Seropositive	10	85.3	1	1.4	11	0.004
Seronegative	58	14.7	69	98.6	16	
Total	68	100	70	100	127	

Table 2: Epidemiological and demographical characteristics of multiple sclerosis patients and control group

Factor	Multiple sclerosis		Control group		Total	Statistical (P-value)
	No.	(%)	No.	(%)		
Sex						
Male	26	38.2	29	41.4	55	0.70
Female	42	61.8	41	58.6	83	
Age group (years)						
1-14	6	8.8	7	10.0	13	0.82
15-29	18	26.5	25	35.7	43	
30-44	32	47.1	29	41.4	61	
≥45	12	17.6	9	12.9	21	
Education						
No School	4	5.9	0	0.0	4	0.14
Some high school	15	22.1	13	18.6	28	
High school	28	41.2	35	50.0	63	
Some college/graduate school	21	30.9	22	31.5	43	
Residency						
Urban	54	79.4	58	82.9	112	0.60
Rural	14	20.6	12	17.0	26	
Occupation						
Unemployed	8	11.8	13	18.6	21	0.26
Worker	10	14.7	17	24.3	27	
Housekeeper	29	42.6	15	21.4	44	
Farmer	3	4.4	5	7.1	8	
Student	10	14.7	10	14.3	20	
Other	8	11.8	10	14.3	18	

frequently among children and young adults probably due to poorer hygiene. The relatively gradual increase in seroprevalence associated with age suggested that soil exposure, which is greatest during the childhood years, may not be the principal mechanism by which persons are exposed to *Toxocara*. In present study, MS consisted of various age groups from children to elderly, age ranging between 3 and 49 years. The seropositivity rate was not affected by age, though there were significantly more seropositive MS patients who were students.

A main finding of the study was the significant difference between seroprevalence in the rural population compared with the urban population to *Toxocara*. Of the ten patients classified as having anti-*Toxocara* antibodies, 70 percent were resided in the rural area. This observations suggested that population from rural area were more likely to be exposed to the parasite.

In conclusion, toxocariasis is a preventable and treatable disease, and our findings further corroborate some observation of an association

between toxocariasis and MS. *Toxocara* as infectious agent could increase the risk of MS that result from damage to the myelin in the central nervous system.

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DISCLOSURE

Conflict of interest: None

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