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Seroepidemiological study of toxoplasmosis in hemodialysis patients of Ahvaz, Southwest of Iran

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Forough Kazemi[1,2], Somayeh Fallahizadeh*[1,2], Mohammad Hossein Feiz-Haddad[2, 3]

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[1]*Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran* [2]*Department of Parasitology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran* [3]*Health Research Institute, Infectious and Tropical Diseases Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.*

***Correspondence**:*
Somayeh Fallahizadeh, Department of Parasitology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
Email: somayeh.labratory@gmail.com.

ABSTRACT

Introduction: *Toxoplasma gondii* (*T. gondii*) is an obligate intracellular protozoan that infects most warm-blooded vertebrates. Because of the immunodeficiency in hemodialysis patients, these individuals are at higher risk for reactivating chronic toxoplasmosis; therefore, a diagnosis of early and definitive in these individuals is highly desirable. Thus, the aim of this study is to investigate seroepidemiology of toxoplasmosis in hemodialysis patients of Ahvaz, southwest of Iran during 2015-2016.

Methods: This is a cross-sectional study. A total of 160 participants, 80 hemodialysis patients (test group) and 80 healthy persons (control group) were randomly selected. IgG and IgM against *T. gondii* was measured by CLIA (Chemiluminescence) and ELISA (Enzyme-linked immunosorbent assay) tests. To analyze the data from Chi-square test, and SPSS statistical software of version 21 was used.

Result: In hemodialysis patients, 35 (43.8%) and 25 (31.3%) were positive for the antibody of IgG by ELISA and CLIA, respectively. In healthy individuals, a positive result of 22 (27.5%) and 13 (16.3%) were obtained by ELISA and CLIA, respectively. In hemodialysis patients, 5 (6.3%) and 4 (5%) was positive by ELISA and by CLIA, respectively. In healthy individuals, a positive of 4 (5%) were obtained by ELISA and CLIA. The antibodies of IgG in hemodialysis patients was significantly higher than healthy individuals by ELISA and CLIA ($P<.05$).

Conclusion: The prevalence of *Toxoplasma* in hemodialysis patients was higher than healthy subjects. Our findings show a relatively high prevalence of the parasite among hemodialysis patients and healthy individuals in Ahvaz. So, the health authorities of Ahvaz city must pay more attention to control of the infection, especially in hemodialysis patients.

Introduction

Toxoplasmosis is a protozoan parasitic infection that has a worldwide distribution. *Toxoplasma gondii* (*T. gondii*) causes toxoplasmosis, that is, an obligate intracellular protozoan. *T. gondii* infects most of the warm-blooded vertebrates, for example, humans, other mammals and birds (1). Seroepidemiological studies show that *T. gondii* antibodies are in serum of one-third of the world adult population (2). Prevalence rates are different in terms of the location and due to differences of culture and health information. Studies show that the toxoplasmosis prevalence rate is 16-40% in North America and Britain, as well as in Central and South America and Europe, it is estimated to be 80-50% (3, 4). Toxoplasmosis occurs mostly in tropical and subtropical areas. *T. gondii* requires 2 hosts to complete its life cycle including the family of cats as the definitive host and vertebrates such as birds and

mammals as an intermediate host. The main routes of transmission include the consumption of water contaminated with oocytes, raw or undercooked meat containing tissue cysts, as well as congenital transmission (5). Individuals of at high risk for toxoplasmosis are immunocompromised persons. Studies have also shown that the infection is related to nervous system disorders such as epilepsy, bipolar disorder and schizophrenia (6). Symptoms in individuals with healthy immune system are mild and transient that include mild fever and swollen lymph glands. In individuals with immune system dysfunction and hemodialysis, latent form of the parasite can be reactivated causing different clinical complicacies from swelling of lymph, damage to the central nervous system, epilepsy, cerebral calcifications, pneumonia and myocarditis (7). Because of the immunodeficiency in hemodialysis patients, these individuals may be at higher risk for reactivating chronic toxoplasmosis. Therefore, an early and definite diagnosis of and definitive in these individuals is highly advisable (8). Since hemodialysis patients are at higher risk for infection of *T. gondii*; thus, the aim of this study is to investigate seroepidemiological aspect of toxoplasmosis in hemodialysis patients of Ahvaz, southwest of Iran in 2015-2016.

Methods

Study area

Ahvaz is a city in the center of Khuzestan Province in Southwest of Iran. The city is 375 kilometers square and its population has been reported as 1,425,891 until 2006. The city has a desert like climate with temperatures above 50° C that is one of the hot cities in the world. The average annual rainfall is about 230 mm. According to the recent report by the World Health Organization (WHO), Ahvaz has the most polluted climate in the world.

Study population

This is a cross-sectional study. A total of 160 participants, 80 hemodialysis patients (test group) and 80 healthy persons (control group) referred to hospitals of Jundishapure University of Medical Sciences (southwest of Iran) were selected randomly. Informed consent was obtained from all participants included in the study (9).

Sampling collection and Serological diagnosis

Five ml blood samples taken from hemodialysis patients as well as healthy subjects were centrifuged. Then, 2 ml of isolated serum was placed in micro-tube and was maintained until the time of testing at 20 °C. To test the samples, they were taken out of the freezer and were melted. Anti-Toxoplasma IgG and IgM antibodies were measured by CLIA (Chemiluminescence) and ELISA (Enzyme-linked immunosorbent assay) tests (10). For Measurement of IgG and IgM by chemiluminescence Architect Kit was used. In ELISA method, IgM and IgG were measured by Ab Capture ELISA and Indirect ELISA methods, respectively.

Ethical consideration

Before performing the research, it was explained to the participants. An informed consent was obtained from all participants included in the study.

Statistical analysis

To analyze the data from Chi-square tests and SPSS, statistical software of version 21 was used. The P-value less than 0.05 was considered significant.

Results

Tables 1 and 2 show IgG antibody of *T. gondii* by ELISA and CLIA in hemodialysis patients and healthy subjects, respectively: For the antibody of IgG, in hemodialysis patients were positive, that is, 35 (43.8%) and 25 (31.3%) by ELISA and CLIA respectively. In healthy individuals a positive result of 22 (27.5%) and 13 (16.3%) by ELISA and CLIA, was obtained respectively. The IgG antibody in hemodialysis patients was significantly higher than healthy subjects in both methods ELISA and CLIA ($P<0.05$).

Table 1: Evaluation of *T. gondii* IgG antibody in hemodialysis patients and healthy individuals by ELISA

			Hemodialysis	Control	Total
IgG	Positive	Count	35	22	57
		%	43.8%	27.5%	35.6%
	Negative	Count	45	58	103
		%	56.3%	72.5%	64.4%
Total		Count	80	80	160

Also, tables 3 and 4 show IgM antibody of *T. gondii* by ELISA and CLIA in hemodialysis patients and healthy subjects, respectively. Antibody of IgM, in hemodialysis patients showed positive data of 5 (6.3%) by ELISA and 4 (5%) by CLIA and in healthy individuals a positive of 4 (5%) was obtained by

Table 2: Evaluation of *T. gondii* IgG antibody in hemodialysis patients and healthy individuals by CLIA

			Hemodialysis	Control	Total
IgG	Positive	Count	25	13	38
		%	31.3%	16.3%	23.8%
	Negative	Count	55	67	122
		%	68.8%	83.8%	76.3%
Total		Count	80	80	160

methods of ELISA and CLIA, respectively. There was no significant difference in the IgM antibody between hemodialysis patients and healthy subjects by both methods of ELISA and CLIA (P>0.05) individuals by ELISA and CLIA (P <.05). The results show that the prevalence of *T. gondii* in hemodialysis

Discussion

T. gondii is an obligate intracellular protozoan from apicomplexa branches and order of coccidia (11). Pregnant women and individuals with immune system disorders are of high priority regarding *T. gondii* (12). Because of the immunodeficiency in hemodialysis patients, these individuals are at higher risk of reactivating toxoplasmosis infection. Therefore, an early definite diagnosis in these individuals is highly advisable (8). Since hemodialysis patients are at higher risk for infection of *T. gondii*; thus, the aim of this study was to investigate seroepidemiological of toxoplasmosis in hemodialysis patients of Ahvaz, Southwest of Iran in 2015-2016. On the other hand, toxoplasmosis occurs mostly in tropical and subtropical regions (5) and due to high heat in the city, the prevalence study of this parasite seems essential in hemodialysis patients in Ahvaz, southwest of Iran. Our findings show that the tests for the antibody of IgG, in hemodialysis patients were positive, that is, 35 (43.8%) and 25 (31.3%) by ELISA and CLIA respectively. In healthy individuals a positive result of 22 (27.5%) and 13 (16.3%) by ELISA and CLIA, was obtained respectively. Also antibody of IgM, in hemodialysis patients showed positive data of 5 (6.3%) by ELISA and 4 (5%) by CLIA and in healthy individuals a positive of 4 (5%) was obtained by methods of ELISA and CLIA, respectively. The antibody of IgG in hemodialysis patients was significantly higher than healthy patients is higher than healthy individuals; these results are consistent with results of previous studies. Similarly, in 2013, Saki et al. in Ahvaz measured IgG and IgM antibodies in hemodialysis patients and healthy individuals by ELISA and PCR tests and showed that the prevalence of this parasite in healthy subjects was26%, but in hemodialysis patients it was found to be 29.3%.

Table 3: Evaluation of *T. gondii* IgM antibody in hemodialysis patients and healthy individuals by ELISA

			Hemodialysis	Control	Total
IgM	Positive	Count	5	4	9
		%	6.3%	5.0%	5.6%
	Negative	Count	75	76	151
		%	93.8%	95.0%	94.4%
Total		Count	80	80	160

The results indicate a significant difference between two groups and the prevalence of this parasite was more in hemodialysis patients (8). Also, Rezavand et al. in 2016 studied the prevalence of *T. gondii* in Iran by ELISA and PCR tests and showed that of 90 patients under hemodialysis, 54 patients (60.0%) for anti-*T. gondi*i IgG antibody and 3 patients (3.3%) for IgM were positive. Of 90 of healthy subjects, 34 cases (37.8%) were positive for IgG antibody and all healthy subjects were negative for IgM (13). In 2014-2015, Rasti et al. in Kashan and Qom (two cities in center of Iran) showed that the prevalence of *T. gondii* was significant difference between the two groups of control (n = 120) and hemodialysis (n = 135) and this parasite was greater in hemodialysis patients. So that was a positive for 63% hemodialysis patients and 33.3% of healthy individuals (14). Similarly, in 2013, Ebrahimzadeh et al. in Iran showed that for IgG antibody, 21 of 37 samples of hemodialysis patients was positive but only, 11 of 37 samples of healthy individuals was positive (15). Maraghi et al. in 2011 in Abadan and Khoramshahr (two cities in southwest of Iran) showed that this parasite was greater in hemodialysis patients. Since, for IgG antibody, 61 of 150 samples of hemodialysis patients were positive but only 39 of 150 samples of healthy individuals was reported positive. Also, for IgM antibody 13 cases of hemodialysis patients waspositive but positive cases were not observed in the control group (16). Also in our findings, there was no significant difference in the IgM antibody between hemodialysis patients and healthy subjects

Table 4: Evaluation of *T. gondii* IgM antibody in hemodialysis patients and healthy individuals by CLIA

			Hemodialysis	Control	Total
IgM	Positive	Count	4	4	8
		%	5.0%	5.0%	5.0%
	Negative	Count	76	76	152
		%	95.0%	95.0%	95.0%
Total		Count	80	80	160

by both methods of ELISA and CLIA (P>0.05) this can be due to the availability of low sample size. These results have also been obtained in other countries. For example, in 2005, Ocak et al. in Turkey showed that there were positive 195 of 255 hemodialysis patients for *T. gondii*, but in control group, from 50 healthy samples, 24 cases were positive. The prevalence of this parasite was greater in hemodialysis patients significantly. Also, the results showed that by increasing treatment duration of hemodialysis patients, the prevalence of this parasite was enhanced (17). The results of all these studies indicate that the prevalence of *T. gondii* in patients undergoing hemodialysis is higher than healthy subjects. The patients due to weakened immunity may activate latent form of toxoplasmosis, which is followed by a lot of complications caused by infection with *T. gondii*. Thus, the results of this research can be a help in planning to control and prevent the parasite in hemodialysis patients. One of the strengths of this study is using two powerful diagnostic tests for IgM and IgG antibodies but the limitation of this study is the low sample size. So, it is suggested to the succeeding researchers to go through the tests using samples with high volumes.

Conclusion

The prevalence of *Toxoplasma* in hemodialysis patients has been higher than healthy subjects. Because of immunodeficiency in hemodialysis patients, latent form of the parasite can be reactivated causing different clinical complicacies such as swelling of lymph nodes, damage to the central nervous system (e.g., epilepsy or cerebral calcification), pneumonia and myocarditis. Our findings show a relatively high prevalence of the parasite among hemodialysis patients and healthy individuals in Ahvaz. So, the health authorities of Ahvaz city must pay more attention to control of the infection, especially in hemodialysis patients.

Ethical disclosure

Before performing the research, it was explained to the participants. An informed consent was obtained from all participants included in the study.

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Author Contributions

All the authors have accepted responsibility for the entire content of this submitted manuscript and approved submission.

Conflict of interest

The authors declare that they have no conflict of interest.

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