Prevalence of *Toxoplasma* infection in veterinary laboratory sciences students comparing to ordinary people: a case–control study

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Abstract *Toxoplasma gondii* causes the foremost wide-spread protozoan infection with a broad variety of host range, which consists of regarding of almost all warm-blooded vertebrates. There are some opinions concerning the probable occupational influence on infections to *Toxoplasma* in veterinary services personnel. The present study aimed to examine influence of studying in veterinary laboratory sciences as a risk factor on the prevalence rate of *Toxoplasma* infection in the students. In this case–control study, 80 blood samples were taken from veterinary laboratory sciences students (VLSS) as a case group and 80 blood samples from ordinary people of general population as a control group with the relatively same age, gender and health condition. Anti-*Toxoplasma* IgG levels in the serum samples were determined using quantitative ELISA method. According to the results, 27 (33.75 %) out of 80 samples of the cases group and also 29 (36.2 %) out of 80 samples of the control group were infected by the parasite. No statistically significant difference observed in the infection rate between the case and control groups ($P = 0.740$, OR 0.931; 95 % CI 0.61, 1.421). The mean serum antibody concentration in infected subjects of case and control groups showed no statistically significant difference ($P = 0.618$, $t = 0.502$). Normality of the data was assumed using Kolmogorov–Smirnov test ($P = 0.806$, $Z = 0.641$). Based on the results, in veterinary laboratory science students, toxoplasmosis is not related to their career

and also the subjects of this group as the other people have the same risk to infect by this protozoan parasite.

Keywords Toxoplasmosis · Occupation · Veterinary students · Risk factor · *Toxoplasma gondii*

Introduction

For the first time, Nicolle and Manceaux described *Toxoplasma gondii* in Tunisia in a rodent, *Ctenodactylus gundi* (Nicolle and Manceaux 1908, 1909). Wolf et al. in 1939 reported the first congenital infection of *Toxoplasma* in an infant (Wolf et al. 1939). The parasite was identified as a coccidian after the 1960s (Weiss and Dubey 2009). Coccidia are parasites that develop in the intestinal epithelium of definitive hosts (Lainson et al. 2005).

Cat is the definite host of *Toxoplasma gondii* and almost all warm-blooded animals even the cat itself, are its' intermediate hosts (Lainson et al. 2005). Oocysts are the environmentally resistant form of its life cycle and are excreted in cat feces, spread out and contaminate the environments. If the intermediate hosts ingest oocysts in feces and or food, soil, water and also undercooked meat containing tissue cysts, it become infected (Dubey 2004; Hill and Dubey 2013). Toxoplasmosis is one of the most widespread parasitic infections found all around the globe, which infects almost all nucleated cells of homoeothermic vertebrates including humans. It is found worldwide and the infection is common among humans and food animals. Nearly one-third of humanity are told to be infected by this parasite (Furtado et al. 2013; Hill and Dubey 2013; Jones and Dubey 2010).

Mostly, the infection manifests no evident symptoms in immunocompetent individuals, however once in case of

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depression of immune system and in congenital transmission, it causes serious diseases (Dubey 2004; Weiss and Dubey 2009). It is commonly causes abortion in farm animals including goats and sheep (Hill and Dubey 2013).

Toxoplasmosis is a widely distributed infection and is present all around the world (Dubey and Jones 2008; Lainson et al. 2005). Infection rates are distributed differently in different geographical areas. There are some factors which may vary the prevalence of the infection in different regions such as environmental condition, cultures and customs and also animal fauna. The infection rate is higher in warm and humid climates and lower in arid and cold areas (Assmar et al. 1997; Lainson et al. 2005; Lehmann et al. 2006).

During last decades prevalence of parasitic infection have been dramatically decreased (Jafari et al. 2014), but toxoplasmosis is still frequent in most of the societies (Weiss and Dubey 2009). The infections which acquired occupationally, mostly have been linked to animal exposures and working in unsanitary workplaces. Improvement in agricultural techniques has dropped the prevalence rate of these kinds of infections, but nonetheless they remain as a problem in developing countries (Panlilio and 2005). Veterinary personnel are a group at risk of imposing to occupational hazards, such as exposure to chemicals, injury, infections, and radiation (Moore et al. 1993).

This study aimed to assess probable occupational cause of toxoplasmosis in veterinarians, based on the results from studying on veterinary laboratory sciences students (VLSS), comparing to general population in northwest of Iran.

Materials and methods

Sampling

In this case–control survey, 80 VLSS enrolled as a case group, who were the third and fourth year in veterinary school at Islamic Azad University, Shabestar branch. Also, a group of 80 ordinary people from general population of Tabriz, Iran were chosen as a control group. All participants in case and control groups were healthy and in the

same age and gender (male). They were tested for the presence of IgG antibodies to *T. gondii* using ELISA method.

Enzyme linked immunosorbent assay (ELISA)

Serum samples were obtained from the two groups and were kept frozen at -20°C until the examination day. The quantitative ELISA kits were purchased from Euroimmune® (Germany) and used for serological evaluation. Serological evaluation of serum samples were performed according to the instruction of the manufacturer and anti-*Toxoplasma* IgG titers higher than 11 IU/ml considered positive, lower than 8 IU/ml negative and in between as the borderline. In case of borderline, the test was performed again a week later and the result was reported as negative or positive.

Statistical analyses

Data were analyzed by SPSS software (version 16.2, SPSS Inc., Chicago, IL, USA) using Student t and Chi square tests. The normality of data was tested by Kolmogorov–Smirnov test. The *P* values less than 0.05 were considered as significant.

Results

The mean age in case group and control group were 23.6 and 25.8 year old, respectively. All the participants in both groups were male. The serum sample of 27 (33.75 %) of cases group (VLSS) and also 29 (36.2 %) out of 80 samples of control group were anti-*Toxoplasma* IgG seropositive. No statistically significant difference observed in the infection rate between the case and control groups using Chi square test ($P = 0.740$, OR 0.931; 95 % CI 0.61, 1.421) (Table 1).

The normality of the quantitative data, the antibody concentrations, was assumed using Kolmogorov–Smirnov test ($P = 0.806$, $Z = 0.641$). The mean serum anti-*Toxoplasma* IgG concentration in infected subjects of cases was 301.96 ± 171.37 IU/ml. also the mean anti-*Toxoplasma*

Table 1 Odds ratio estimated for *Toxoplasma* infection among VLSS comparing to ordinary people

Subject	Infection		Total	OR	95 % CI	<i>P</i>
	Yes n (%)	No n (%)				
VLSS	27 (33.8)	53 (66.2)	80	0.93	0.61, 1.421	0.740
Ordinary people	29 (36.2)	51 (63.8)	80	1		
Total	56	104	160			

Table 2 The mean anti-*Toxoplasma* antibody concentrations among infected VLSS and control group

Variable	VLSS (n = 27)		Ordinary (n = 29)		Difference	df	<i>t</i>	<i>P</i>
	Mean	SD	Mean	SD				
Ab titer (IU/ml)	301.96	171.37	280.08	153.32	21.88	54	0.504	0.616

IgG concentration in serum samples of the infected controls showed very close to that of cases, 280.08 ± 153 IU/ml. The observed numerical difference between the two groups in mean anti-*Toxoplasma* IgG concentration was not statistically significant by *t* test ($P = 0.618$, $t = 0.502$) (Table 2).

Discussion

Based on the findings of this study, anti-*Toxoplasma* IgG seropositivity is prevalent in the human population of northwest of Iran. Also risk factors for toxoplasmosis is a complex problem in northwest of Iran, which some of the risks studied in this area (Jafari et al. 2012; Rasouli et al. 2014). One other probable occupational risk has been studied in the present study and the results showed that being a veterinary personnel is not a risk factor for acquiring the infection. Based on this research results, in VLSS, toxoplasmosis is not related to their career and the subjects of this group as the other people, have the same probability to infect with this protozoan parasite.

The overall prevalence of *Toxoplasma* infection was 35 %, which by considering other studies performed on general population in Iran, indicates approximately the same range of prevalence of chronic toxoplasmosis (Fallah et al. 2008; Hajsoleimani et al. 2012; Salahi-Moghaddam and Hafizi 2009; Sharif et al. 2007) and lower than some other population based studies (Mostafavi et al. 2011, 2012). Assmar et al. 1997 carried out a large-scale epidemiological study on the prevalence of infection in general population of Iran. They found the overall prevalence 51.8 % which is markedly higher than what we found. They assumed that the infection is more frequent in humid areas than the arid regions (Assmar et al. 1997).

Several studies have been carried out in various populations, but the occupational aspect of toxoplasmosis is not still well studied in Iran, especially in veterinary students and clinicians. Some argue about the probable occupational influence on infections with *Toxoplasma* in veterinary services personnel and students. According to results of this study there is no evidence about occupational toxoplasmosis in VLSS and the subjects of this group as the other people have the same risk to be infected. There also was a broad diversity in background

factors such as food habits, being in-contact with cat, soil related jobs, age and interest in animals that can make biases (Fan et al. 2001).

Fecal sample handling and examining of them were the typical activities of VLSS. Observing of no significant difference between the prevalence rates of the infection and also the mean antibody concentrations between the people from general population and VLSS was not so surprising because some other studies concluded the same. For example, it is reported that being in-contact with cat in employees of university is not a risk for the toxoplasmosis, which is reasonable that probably they are aware of these risk factors and subsequently they would be cautious about the prevention (DiGiacomo et al. 1990; Elmore et al. 2010; Parker and Holliman 1992; Sengbusch and Sengbusch 1976; Shuhaiber et al. 2003; Torda 2001).

Considering the other epidemiologic characteristics of the infection for the two studied groups, it can be concluded that toxoplasmosis is not occupationally acquired disease for VLSS and other factors such as soil related jobs and eating habits are the most probable important causative risks of toxoplasmosis (Bobic et al. 2007; Jafari et al. 2012; Jones et al. 2009).

This study, as well as other similar studies, does not concluded in the higher risk of toxoplasmosis in veterinary personnel, which suggests the other probably different mode of transmission in northwest of Iran.

To define the exact risk factors especially in occupational aspect, a large-scale study with a greater sample size and sequential sampling for several years with follow up is needed. These studies firstly should be carried out on the at-risk populations such as pregnant women and immunocompromised/suppressed patients to illustrate the exact risk in every population and subsequently control the transmission in these people (Bertoli et al. 1995; Hofhuis et al. 2011; Zimmermann 1976). Limited budget is the main limitation for such studies like ours, which can be solved by health organizations considering the importance of this zoonotic infection.

Conclusion

Based on the research results, in veterinary laboratory sciences students, toxoplasmosis is not related to their

career and the subjects of this group as the other people have the same risk to infect by this protozoan parasite.

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Conflict of interest The author declares that have no conflict of interest.

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