

Significance of chronic toxoplasmosis in epidemiology of road traffic accidents in Russian Federation Version 2

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Abstract

Objectives

The objectives of our studies were to determine:

a) the prevalence of chronic toxoplasmosis in population of Moscow city and Moscow region; b) to determine a probable role of the disease in the epidemiology of the RTA in Russian Federation.

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Guidelines

Background

Worldwide interest and concern to the emerging problem of toxoplasmosis in general and to its' chronic form in particular had been demonstrated during the last 15-20 years, when new dimensions of the disease had been established. Results of the monitoring of *Toxoplasma* -infected persons have revealed behavioral changes among them as compared with uninfected persons. The intensity of such changes has closely correlated with the duration of chronic toxoplasmosis. It appears that the mechanism determining the personality changes is associated with an increase in the production of the neurotransmitter dopamine, affecting motor activity, aggression and social behavior of a person. Once in the nerve or inside the muscle tissue, the parasite forms cysts that cause the development of chronic toxoplasmosis. It was found that *Toxoplasma* localized in the nerve cells of the brain, stimulates the production of dopamine, thus reducing the reaction time and concentration and, thereby, increases the risk of various incidents that have been convincingly demonstrated in epidemiological studies in the Czech Republic and the Republic of Turkey. Subsequent observations among toxoplasmosis - infected persons, conducted in various countries, confirmed the significant behavioral changes, 2

including personality changes, IQ loss and altered psychomotor activity, particularly increased risk of involvement in road traffic accidents.

Study population and methods of recruitment

In order to establish a general prevalence of chronic Toxoplasmosis among residents of Moscow city, examinations had been carried out among persons attending the Outpatient Department at the Clinical Center of the Sechenov First Moscow State Medical University. No special criteria had been selected for examination in terms of age-, sex- and occupation. A total of 1272 persons had been examined.

The main study represented by two groups: experimental and control.

The experimental group consisted of persons in a possession of valid driving license, and being hospitalized because of a road traffic accident for which they had been held responsible. All persons in the experimental group were the patients of the Sklifosovsky Medical Emergency Institute, Moscow. The criteria for inclusion were: a) prove that admitted person was driving at the time of accident;

b) evidence that their actions/behavior had led to the occurrence of the accident;

c) age – from 18-45 years.

The criterion for exclusion was driving at the time of an accident under the influence of alcohol/drugs. A total of 100 persons constituted the experimental group – 65 men and 35 women.

The control group consisted of 152 healthy persons aged 18-45 years (82 men and 70 women), who were undertaking routine medical examination at the Clinical Centre of the Sechenov University.

Study design

An analytical epidemiological “case-control” study was carried out. All study patients tested for the presence of IgG and IgM specific antibodies to *Toxoplasma gondii*. Determination of specific immunoglobulin G and M in the blood serum of 3

the study groups (experimental and control) were determined by enzyme-linked immunosorbent assay (ELISA) test-kits “Vector-Toxo of IgG” and “Vector Toxo-IgM” producer JSC “VECTOR-BEST”. An indicator of chronic toxoplasmosis in the patient was a presence of IgG in the absence of IgM. Appendix 1 provides a schematic of the study design.

Statistical analysis

Statistical significance of the results both in the experimental and control groups was obtained through the use of χ^2 criterion, and calculated the odds ratio (OR) with a level of reliability not less than 95%. The Statistical Package EpiInfo Version was employed for calculations.

To assess the strength of the connection between the presence of toxoplasmosis in the experimental and control groups, and the belonging to the compared groups (driver-control), we calculated the Pearson Correlation, which was 0.201 ($p = 0.01$).

Ethics

The study was approved by the Research Ethics Board of Health of the Sechenov First Moscow State Medical University (protocol № 04-13, 10.04.2013). Participants in the experimental and control groups were informed about the purposes of the study, and informed consent in verbal form was obtained before enrollment in the study.

Results

The prevalence of chronic toxoplasmosis in the residents of Moscow city is presented in table (Appendix 2).

The results of the examination of blood serum in the experimental and control groups are presented in Appendices 2 and 3.

As seen in Table (Appendix 3), the immunoglobulin M was absent in both groups, whereas immunoglobulin G was present in 45% of those tested in the experimental group compared to 26% in the control group. The absence of the immunoglobulin 4

IgM in conjunction with the presence of IgG suggests the presence of persons with exclusively the chronic form of toxoplasmosis in both the experimental and control groups. It was found that the number of seropositive subjects with IgG in the experimental group was significantly higher than that in the control group. Thus, among the persons involved in traffic accidents who were responsible for their occurrence, the incidence of cases with chronic toxoplasmosis was more than twice that in the control group.

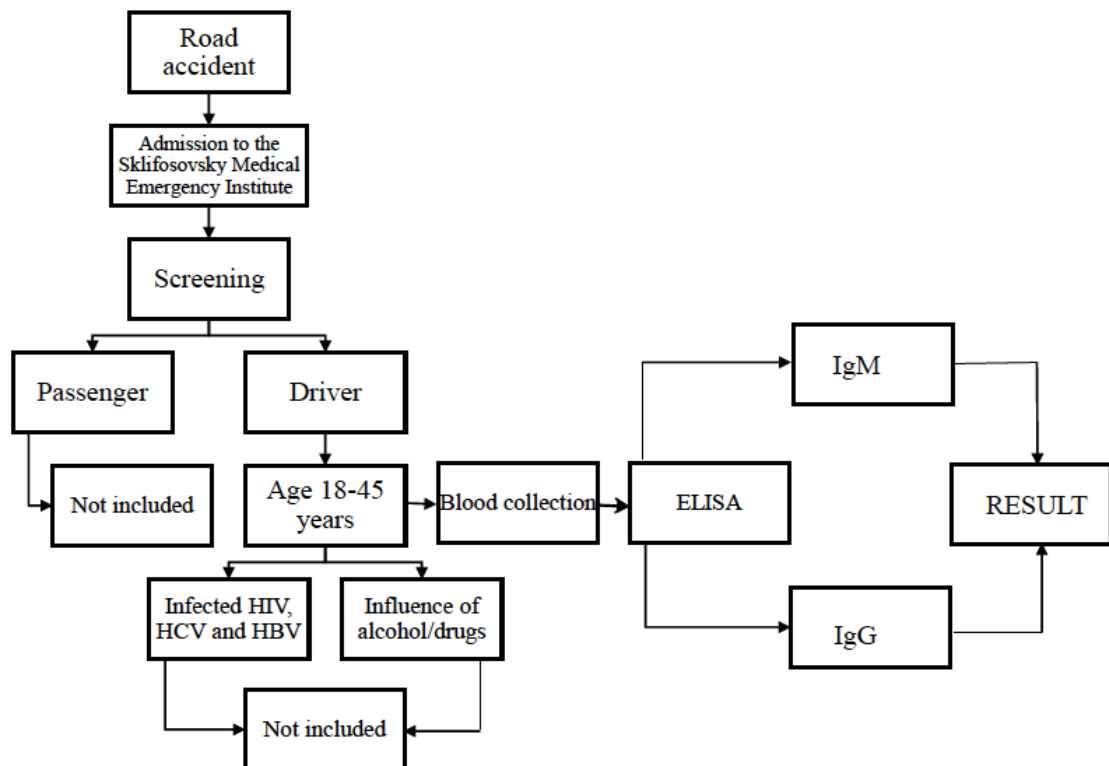
The data in the table (Appendix 4) show that the effect of toxoplasmosis was significant and similar for men ($OR=2.2$, $CI_{95}=1.04-4.66$, $p<0.02$) and women ($OR=2.6$, $CI_{95}=1.02-6.8$, $p<0.02$). There is no statistically significant difference in the ratio of seropositive men ($p<0.02$) and women ($p<0.02$) in the experimental and control groups. It can also be seen that there was practically no difference in the prevalence of chronic toxoplasmosis among men and women in the control group (26.8% and 24.3%, respectively). Almost the same trend was found in the experimental group among men and women, although the level of prevalence was almost 2 times higher compared with the control group.

To assess the strength of the connection between the presence of toxoplasmosis in the experimental and control groups, and the belonging to the compared groups (driver-control), we calculated the Pearson Correlation, which was 0.201 ($p = 0.01$).

The data in the table (Appendix 5) show that there was no statistically significant difference between the studied groups with respect to sex and age.

The partial correlation coefficient with respect to age and sex was calculated as 0.202 ($p=0.01$). Similar results were obtained in a stratified analysis using an estimate of the overall odds ratio as the Mantel-Haenszel Common Odds Ratio Estimate, when stratified by sex. The adjusted OR was 2.35 CI 1.37-4.03.

Appendix 1. The block diagram of the study design.



Appendix 2. Prevalence of Chronic Toxoplasmosis Among the Residents of Moscow City (Russian Federation), 2015.

Group	Examined	Positive results (ELISA test)	
		Absolute number	Percent (%)
Total number	1272	323	25.39
Men	497	120	24.14
Women	775	203	26.19

Appendix 3. Comparative Prevalence of Immunoglobulins M and G to *Toxoplasma gondii* in the Experimental Group and the Control Group.

Group	examined	Absolute number		Positive results (%)	Odds ratio	C.I. ₉₅	p-values
		IgM	IgG				
Case	100	0	45	45.00	2.37	1.34-4.2	0.001
Control	152	0	39	25.66			

Appendix 4.

Comparative Gender Prevalence of Chronic Toxoplasmosis in the Experimental Group and the Control Group.

Group	Experimental group			Control group			Odds ratio	C.I. ₉₅	p-values
	Examine d	Positive results		Examined	Positive results				
		Absolute number	Percent (%)		Absolute number	Percent (%)			
Men	65	29	44.61	82	22	26.83	2.2	1.04-4.66	0.02
Women	35	16	45.71	70	17	24.28	2.63	1.02-6.8	0.02

Appendix 5. The Results of Multivariate Analysis.

Factor	Total (252)	Experimental (100)	Control (152)	p-values
Men	147 58,3%	65 65,0%	82 53,9%	p=0,091
Women	105 41,7%	35 35,0%	70 46,1%	
Age	34,30 SE=7,11 SD=0,45	34,31 SE=7,77 SD=0,78	34,50 SE=6,66 SD=0,54	p=0,836

Protocol

Block diagram of the study design

Step 1.

