Toxoplasma chorioretinitis in primary school children in Tehran, Iran, 2003–2004

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Summary

Background:

The evaluation of toxoplasma chorioretinitis is of utmost importance in the early diagnosis, treatment, and prevention of visual problems that can otherwise lead to permanent blindness. The aim of this study was to determine the prevalence of toxoplasma chorioretinitis among primary school students in Tehran.

Material/Methods:

This cross-sectional study involved 1529 healthy primary school students from the 19 school districts in Tehran (2003–2004). The mean age was 9.7±1.55 years. Serum anti-toxoplasma level (IgG) was measured by quantitative chemiluminescent immunoassay (CLIA) and students with positive result were referred to an ophthalmologist for further evaluation.

Results:

Of the 1529 students, 1377 (90%) had negative and 152 (10%) had positive serum titers. Seroprevalence was higher in boys (12%) and increased with age. Sixty-five students (43%) were referred to an ophthalmologist and acute chorioretinitis was diagnosed in a nine-year-old boy who was given anti-toxoplasma medication and was free of any active lesion one year later.

Conclusions:

Seroprevalence was lower than in some other studies performed in Iran, which can be attributed to climate conditions and urban life. Considering the low rate of visits to an ophthalmologist, this indicates the need for increased awareness regarding the disease and its complications.

key words: children • chorioretinitis • toxoplasmosis
**BACKGROUND**

Toxoplasmosis is one of the most common parasitic infestations common to both humans and animals and is found throughout the world. Its prevalence varies in different geographical regions depending on age and dietary habits [1]. There is an increasing prevalence of infection with advancing age. The prevalence of infection ranges from 5.7% to 87% in Iran [2–8] and has been reported to be between 0% to more than 90% in the world [9–12]. The prevalence of infection is associated with factors such as frequency of contact with domestic animals, crying, climatic conditions such as humidity and rate of rainfall, as well as contact with contaminated soil [13]. The infection rate is also high in areas where semi-cooked meat is consumed [9,14,15]. The clinical ophthalmological manifestations of toxoplasmosis vary greatly, the most common being chorioretinitis (92%). This condition is usually diagnosed after the first year of life and is associated with other ophthalmic lesions in 71% of cases, the most common being microphthalmia and strabismus [16]. In one study, 13.9% of subjects with ophthalmic toxoplasmosis were blind [17], and in another study, 74% of subjects had congenital and 26% had developmental ophthalmic toxoplasmosis, making a total of 91% of cases with chorioretinitis [10].

Recent findings indicate that developmental infection may play the main role in causing eye infection. In a revised study which compared the overall risk of ophthalmic toxoplasmosis due to intrauterine infection with that of infection after birth, it was seen that at least two thirds of the cases occurred as a result of infection after birth [18]. Considering that Toxoplasma is the most common cause of primary retinochoroiditis [16], and that around 88% of congenital toxoplasma retinochoroiditis cases are actually subclinical [19], early diagnosis and prompt treatment will greatly reduce the risk of blindness. Failure of diagnosis can otherwise lead to visual defects and even blindness. The duration between primary infection and the development of ophthalmic manifestations may take 3.5 years [20]. Of course, the sole finding of infection during this period is positive serology. In addition, as previously stated, attention to the increasing role of developmental infection in ophthalmic toxoplasmosis indicates the importance of screening in children. Considering these facts, this study aimed to determine the frequency of infection with Toxoplasma and chorioretinitis in apparently healthy primary school children so as to provide useful suggestions to the relevant authorities about prevention of toxoplasmosis and visual defects.

**MATERIAL AND METHODS**

Multistage sampling was performed in primary school children from all 19 school districts in Tehran (2003–2004) such that four girls’ and boys’ schools were randomly chosen from each school district. The students were enrolled in the study voluntarily and with full knowledge about the procedure of the study only after the health authority of each school had obtained parental consent. The children were evaluated through questionnaire, physical examination, and laboratory tests. The questionnaire comprised data pertaining to demography, date of specimen collection, school district, name of school, class grade, history of vaccination, history of current disease, type of disease, type of water used, dietary habits, and history of contact with cats.

**Table 1. Toxoplasma antibody titer (IgG) in primary school children from the 19 school districts in Tehran.**

<table>
<thead>
<tr>
<th>Antibody titer (IgG)</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1371</td>
<td>89.7</td>
</tr>
<tr>
<td>Borderline</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>Positive</td>
<td>152</td>
<td>9.9</td>
</tr>
<tr>
<td>Total</td>
<td>1529</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Two milliliters of venous blood was taken from each subject by a single experienced laboratory technician and the sera were separated and stored at –20°C. There were no complications due to blood specimen collection. Serum toxoplasmosis antibody titer (IgG) level was determined by an experienced laboratory technician by chemiluminescent immunoassay (CLIA) (LIAISON Kit, Italy LIAISON Toxo IgG [310 700]). According to this kit, IgG antibody titers <6 IU/ml, between 6–8 IU/ml, and >8 IU/ml were considered as negative, borderline, and positive, respectively. CLIA has a specificity of 99.68% and a sensitivity of 99.35%. All seropositive cases were referred to an ophthalmologist for further evaluation regarding chorioretinitis and the results were reported in writing.

The information in the questionnaire, antibody titers, and retinal findings were entered into a computer and subsequently analyzed by SPSS computer software. Analytical tests including the chi-square test (qualitative variables) and t-test (quantitative variables) were used and p values less than 0.05 were considered as significant.

**RESULTS**

Out of 1529 school children, 1377 (90%) were seronegative and 152 (10%) were seropositive (Table 1). Among the girls, 785 (92%) and 71 (8%) and among the boys, 592 (88%) and 81 (12%) were seronegative and seropositive, respectively (Table 2). This difference was statistically significant (p=0.015). As shown in Table 2, seropositivity increases with advancing age. The difference observed between various ages was significant using the chi-square test (p=0.059). Thirty-one subjects gave a history of contact with cats, six (9%) of whom were seropositive (Tables 3, 4). This difference, however, was not significant (p=0.059). Contaminated water had been used by 29 subjects, 17% of whom were seropositive. Among those who had used hygienic water, 10% were seropositive, the difference being not significant (p=0.230) (Table 5).

Overall, 152 students were found to be seropositive and were thus referred to an ophthalmologist. However, only 65 of them (43%) actually visited the ophthalmologist, and only one case of active chorioretinitis was detected. This was a nine-year-old boy having IgG >500 IU/ml in whom physical examination was normal and signs of acute toxoplasmosis were absent. He complained of blurred vision and would read with his eyes close to his book. Unfortunately, no attention had been paid to this condition. Fundoscopic examination of both eyes revealed bilateral myopia and unilateral acute chorioretinitis. The boy had poor personal hygiene and he stated a history of prolonged contact with
cats as well as the use of well water. He was given a six-week course of antitoxoplasma therapy (pyrimethamine, sulfadiazine, folinic acid, and prednisolon) after which he was re-examined by an ophthalmologist. The lesions were reported to have become quiescent and further examination after one year showed no abnormal finding.

<table>
<thead>
<tr>
<th>Age sex</th>
<th>Antibody titer</th>
<th>6 years</th>
<th>7 years</th>
<th>8 years</th>
<th>9 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>6 years</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Negative</td>
<td>26</td>
<td>93</td>
<td>6</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>Positive</td>
<td>2</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>100</td>
<td>6</td>
<td>100</td>
<td>128</td>
</tr>
</tbody>
</table>

Table 2. Toxoplasma antibody titer (IgG) in primary school children from the 19 school districts in Tehran based on age group and sex.

<table>
<thead>
<tr>
<th>Age sex</th>
<th>Antibody titer</th>
<th>10 years</th>
<th>11 years</th>
<th>12 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>10 years</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Negative</td>
<td>151</td>
<td>93</td>
<td>117</td>
<td>84</td>
</tr>
<tr>
<td>Positive</td>
<td>12</td>
<td>7</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>163</td>
<td>100</td>
<td>132</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3. Toxoplasma antibody titer (IgG) in primary school children from the 19 school districts in Tehran based on contact with cat.

<table>
<thead>
<tr>
<th>Contact with cat</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Negative</td>
<td>25</td>
<td>80.6</td>
<td>1297</td>
</tr>
<tr>
<td>Positive</td>
<td>6</td>
<td>19.4</td>
<td>133</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.0</td>
<td>1430</td>
</tr>
</tbody>
</table>

Table 4. Contact with cat in primary school children from the 19 school districts in Tehran based on age group and sex.
Table 5. Toxoplasma antibody titer (IgG) in primary school children from the 19 school districts in Tehran based on drinking water.

<table>
<thead>
<tr>
<th>Antibody titer</th>
<th>Contaminated</th>
<th>Healthy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Negative</td>
<td>19</td>
<td>82.6</td>
<td>1356</td>
</tr>
<tr>
<td>Positive</td>
<td>4</td>
<td>17.4</td>
<td>148</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>100.0</td>
<td>1504</td>
</tr>
</tbody>
</table>

\( p = 0.230 \).

**DISCUSSION**

In this study, the prevalence of positive serology to Toxoplasma was estimated to be around 10% in Tehran, this rate being higher among boys and at higher ages. Less than half of the seropositive cases visited an ophthalmologist, and among those who did, only one case of active chorioretinitis was detected. Toxoplasmosis is one of the most frequent parasitic diseases common to both humans and animals and has a worldwide distribution. Its prevalence varies in different geographical regions according to age and dietary habits [1], with a reported range of 0% to almost 100% in different regions of the world [8]. In comparison with other Iranian studies, the infection rate varies in different regions and has been reported to be 15% in Islamshahr, 6% in Karaj, 39% in Ahwaz, 41% in Kerman, and 60% in the Caspian Littoral [2–4,9,21]. In Greece, however, 6- to 15-year-old subjects had an infection rate of around 11% [22], which corresponds to our findings. The differences observed among different geographical regions depend, to a certain extent, on environmental conditions which affect the viability of the Toxoplasma oocyst; the infection rate is lower in most areas with hot and dry or cold climates [9]. Other factors affecting the infection rate include living conditions and environmental contamination [2,3], presence or absence of cats in the living environment [8], dietary habits [1], and contact with contaminated soil. Studies report that the prevalence of infection is higher in rural areas, where there is more contact with contaminated soil and domestic animals. The prevalence of infection was higher among students who had been in contact with cats. This is in agreement with other studies performed in rural areas where the rate of contact with contaminated soil and cats is high [13]. In areas where there is less contact with cats, the rate of infection is almost zero [8]. Seventeen percent of the subjects who used contaminated water were seropositive, which is in agreement with other reports [13]. The infection rate is also high in areas where semi-cooked meat is consumed [9,14,15]. In Holland, for example, the infection rate has dropped dramatically during the last few years, which is largely attributed to changes made in the storage and cooking of meat and modern cattle-raising methods in which contact of cattle with the free environment is decreased to the lowest possible level [23].

In this study, the infection rate increased with advancing age and peaked in the 12-year-old age group (15.5%), which is similar to studies performed in other regions of Iran [2–8]. It seems that the relationship between advancing age and infection rate is due to repeated contact with the Toxoplasma parasite [1–3,8,13]. In our study, the infection rate was significantly higher among males (\( p = 0.015 \)).

The prevalence of congenital toxoplasmosis in the U.S. varies from 1/1000 to 1/8000 live births [21,24,25]. Fifty percent of all congenital toxoplasmosis cases involve the eyes, 85% of which are chorioretinitis and visual defects [24,26–30]. Retinal involvement is detectable after the first year of life [16]. Chorioretinitis is one of the most important causes of blindness throughout the world [23]. Toxoplasma accounts for 35% of all cases of chorioretinitis in the U.S. and western Europe, which may be brought about by primary infection or upon reactivation of congenital infection [24,30]. In most cases, complications occur during the second and third decade of life. One of the characteristics of developmental chorioretinitis is unilateral involvement of the eyes [29,30]. Chorioretinitis occurs in 1% of subjects with normal immunity and acute toxoplasmosis [24,31]. In a study performed during a 13-year period in Paris it was seen that among the 49 cases with developmental toxoplasmosis, 45 developed ophthalmic lesions, which is more than expected [32], and 13.9% of these subjects became blind [17]. In our study, only one case of active chorioretinitis was found: a nine-year-old boy who experienced the need to read at a close distance from his book. He stated the use of well water (contaminated water) for drinking purposes as well as the use of home-grown vegetables. He also had a history of prolonged and repeated contact with cats. His serum IgG antibody titer was >500 IU/ml. History of close contact with cats, the use of contaminated water, and the unilateral nature of his chorioretinitis indicate a developmental nature. On the other hand, since the systemic signs of acute toxoplasmosis were absent, it may have been a flare-up of congenital infection. The patient was reexamined by an ophthalmologist after receiving a one-month course of anti-toxoplasma therapy. The lesion was reported to have subsided and further assessment after one year showed complete improvement.

One of the problems we are faced with in diagnosing or treating ophthalmitic toxoplasmosis is unawareness of and the lack of attention paid to this condition. In our study, of the 152 seropositive subjects who had been told to visit an ophthalmologist, only 43% did so, even though it was free of charge. Physicians and ophthalmologists are also faced with this problem such that in the U.S, although most doctors had visited patients with active or quiescent ophthalmic lesions during the last two years, they were unaware of the correct method of diagnosis and treatment of this disease [29].

**Conclusions**

We recommend screening for toxoplasmosis to be performed from the time of birth [31]. Congenital toxoplasm-
mosis can be prevented by limiting the prevalence of infection throughout the community. In order to achieve such goals, it is suggested that the health and education authorities inform the community about the modes of transmission of infection (water and vegetables contaminated with the Toxoplasma egg, contaminated soil, semi-cooked meat) and ways of its prevention. Regarding the probable role of developmental infection, more attention should be paid to the general health of school children and to health education by school health instructors. It is also important to refer all suspicious cases to an ophthalmologist and to provide early diagnosis and prompt treatment.

Comprehensive ophthalmologic examination for health evaluation which should be performed at three stages:

- on entering school,
- the first year of secondary school,
- the first year of higher school.

Acknowledgements

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