ORIGINAL RESEARCH

Seroprevalence of *Toxoplasma gondii*, rubella and cytomegalovirus among pregnant women in western region of Turkey

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Abstract

Purpose: Prenatal screening for antibodies to *Toxoplasma gondii* (*T. gondii*), rubella virus and cytomegalovirus (CMV) infectious agents is an important tool in this process. The aim of this study was to determine the seroprevalence of these infections through antenatal screening in Kocaeli region.

Material and Methods: 1972 samples of sera were tested for antibodies to TORCH agents known to cause serious congenital infections: *T. gondii*, rubella, CMV. Anti-*Toxoplasma*, anti-rubella and anti-CMV IgM and IgG antibodies were assayed by ELISA method using Abbott kits (AxSYM, Abbott, USA) according to the manufacturer's instructions.

Results: Of 1972 pregnant women, seropositivity for anti-toxoplasma IgG antibody was found in 952 (48.3%), while 8 (0.4%) of the subjects tested were positive for the anti-*Toxoplasma* IgM antibody only, and 31 (1.6%) of the subjects tested were positive for anti-*Toxoplasma* IgG+IgM antibodies together. The seropositivities for anti-rubella IgG, IgM and IgG+IgM together were found in 1896 (96.1%), 4 (0.2%) and 35 (1.8%) of the pregnant women, respectively. The seropositivities for anti-CMV IgG, IgM and IgG+IgM together were found in 1900 (96.4%), 13 (0.7%) and 37 (1.9%) of the pregnant women, respectively.

Conclusion: Widespread population screening may contribute to the prevention of congenital infections due to TORCH agents. Because of the high seropositivity of *T.*

gondii, rubella and CMV in pregnant women, preventive measures should be taken.

Primary infections with *T. gondii*, rubella virus and cytomegalovirus (CMV) in pregnant women can lead to serious complications that are initially unapparent or asymptomatic. Between 2 % and 3 % of all congenital anomalies are attributed to perinatal infection. The TORCH complex (*T. gondii*, other microorganisms (eg, syphilis), rubella virus, CMV, and herpes simplex virus) includes some of the most common infectious agents associated with these congenital anomalies.¹⁻⁴ Typically, these organisms cause only asymptomatic or mild infection in the mother but can cause much more serious consequences in the fetus. A very important component of prenatal care is the recognition of these infections in the mother and fetus. Identification of susceptible women is essential so that early treatment can be offered. The aim of this study was to determine the seroprevalence of *T. gondii*, rubella and CMV infections through antenatal screening in Kocaeli region, Turkey.

Materials and methods

The study was performed at Kocaeli University Hospital. Kocaeli is an industrial region and could be taken as a model for the general population of Turkey with its socioeconomic, cultural and ethnic diversity. The study protocol was approved by local research ethics committees and informed consent was obtained from all participants.

Between March 2005 to January 2007, a total of 1972 serum samples were tested for antibodies against *T. gondii*, rubella and CMV. The records of pregnant women in their first trimester who had come for their first antenatal visit to our hospital were included in the study. Anti-*Toxoplasma*, anti-rubella and anti-CMV IgM and IgG antibodies were assayed by an enzyme linked immunosorbent assay method using Abbott kits (AxSYM, Abbott, USA) according to the manufacturer's instructions. Anti-*Toxoplasma* IgM antibody titres greater than a 0.490 index and anti-*Toxoplasma* IgG antibody titres greater than 3.0 IU/ml were considered positive. Anti-rubella IgM antibody titres greater than 0.600 and anti-rubella IgG antibody titres greater than 10.0 IU/ml were considered positive. Anti-CMV IgM antibody titres greater than 0.500 and anti-CMV IgG antibody titres than 15.0 AU/ml were considered positive. Statistical Package for Social Sciences (SPSS, ver 10.0) software was used to calculate descriptive statistics.

Results

The mean age of the participants was 28.56±4.3 y (min 15y, max 47 y). Of 1972 pregnant women, positivity for anti-*Toxoplasma* IgG antibody was 952 (48.3 %), while 8 (0.4 %) of the subjects tested were positive for the anti-*Toxoplasma* IgM antibody, and 31 (1.6 %) of the subjects were tested positive for both anti-*Toxoplasma* IgG+IgM antibodies. The seropositivities of the pregnant women for anti-rubella IgG, IgM and IgG+IgM were 1896 (96.1 %), 4 (0.2 %) and 35 (1.8 %), respectively. The seropositivities of the pregnant women for anti-CMV IgG, IgM and both

TABLE 1. Seropositivity of anti-*Toxoplasma*, anti-rubella and anti-CMV antibodies in pregnant women.

Variables	Positive % (n)
Anti- <i>Toxoplasma</i> IgG	48.3 (952)
Anti- <i>Toxoplasma</i> IgM	0.4 (8)
Anti- <i>Toxoplasma</i> IgG+ IgM	1.6 (31)
Anti-rubella IgG	96.1 (1896)
Anti-rubella IgM	0.2 (4)
Anti-rubella IgG+ IgM	1.8 (35)
Anti-CMV IgG	96.4 (1900)
Anti-CMV IgM	0.7 (13)
Anti-CMV IgG+ IgM	1.9 (37)

IgG+IgM were 1900 (96.4 %), 13 (0.7 %) and 37 (1.9 %), respectively. The rates of seropositivity for *Toxoplasma*, rubella and CMV IgG and IgM are shown in Table 1.

Discussion

T. gondii, CMV and rubella cause only asymptomatic or mild infection in the mother but can have much more serious consequences for the fetus. Congenital, intra-uterine infections are often the cause of congenital abnormalities, intra-uterine growth deficiencies and foetal death, resulting in both economic and social concerns. A very important component of prenatal care is the recognition of these infections in the mother and the fetus. Currently, routine prenatal screening for some TORCH infections is done during the first trimester because patients who are seronegative can develop primary infection, which has the risk of vertical transmission to the fetus.⁵

In this study, we determined the anti-*Toxoplasma* IgG, anti-*Toxoplasma* IgM and anti-*Toxoplasma* IgG+IgM seropositivities in pregnant women as 48.3 %, 0.4 % and 1.6 % respectively. The seroprevalence of *T. gondii* infections ranges between 7.7 and 76.7% in different countries: United Kingdom, 9.1-7.7%^{6,7}; France, 71%⁸; Norway, 10.9%⁹; Spain, 18.8%¹⁰; Indian, 45%¹¹; Iran, 51.8%¹²; Sweden, 14-25.7%¹³; Brazil 50-76%¹⁴, and Nigeria 75.4%.¹⁵ In the United States, the overall age-adjusted seroprevalence of toxoplasmosis is 22.5%, and 15% among the women

of childbearing age.¹⁶ The National Health and Nutrition Examination Survey (NHANES), found that the prevalence of toxoplasmosis has declined in the past decade. This reduction prevalence was likely related to a reduction of *T. gondii* in cysts in meat through the efforts of meat producers, education of physicians and the public and other food-related factors (frozen pre-prepared meal and frozen meat markets). The reduction in *T. gondii* seroprevalence was not due to fewer cats in the United States.¹⁷ Seroprevalence of *Toxoplasma gondii* infection in pregnant women in Mexico was reported as 6.1%-60%.^{18,19} High *T. gondii* seroprevalence has been found in countries (such as France) where undercooked meat is commonly eaten.⁸ In Turkey, the overall rate of seropositivity for *T. gondii* antibodies is between 43-85%.²⁰⁻²⁴ Seroprevalence of *Toxoplasma* was lower in the western part of Turkey than in the eastern and mid-anatolian parts.^{20,24} The high seroprevalence of *T. gondii* in Turkey is related to the presence of a great number of stray cats in both rural and urban areas of the country. The Turkish diet, which consists of large amounts of raw, wild vegetables, salads and undercooked meats that could easily be contaminated with parasite.

These results indicate that Turkey has a relatively high *T. gondii* seroprevalence in comparison with other nations such as United States, United Kingdom, Sweden, Norway and Spain.^{6,7,9,10,13,16} The climatic, topographic and socioeconomical characteristics of these countries may explain the lower *T. gondii* seroprevalence found there.

The incidence of congenital *Toxoplasma* infection also differs from country to country and is estimated to affect 1-10 per 10,000 newborns in Europe.²⁵ Very little is known about congenital toxoplasmosis in Turkey. Primary prevention of toxoplasmosis in the seronegative pregnant mother can be achieved through education to practice precautionary measures, which include washing the hands frequently, washing all vegetables and fruits and, most importantly, avoidance of eating raw meat.

In our study, the seropositivities of the pregnant women for anti-rubella IgG, IgM and IgG+IgM were 96.1 %, 0.2 % and 1.8 %, respectively. Seropositivities of rubella were reported to be 87 % in USA²⁶; 93.3-94% in Saudi Arabia^{27,28}; 98% in Spain²⁹; 95.3% in Mozambique³⁰ and 95-96.2% in Turkey^{22,31,32} in pregnant women. The epidemiology of rubella infection has been modified ever since the introduction of the rubella vaccination. Danovaro-Holliday et al²⁶ were reported that childhood immunization strategies alone may not be enough, and that workplace vaccination of high-risk adults needs to be considered. Although rubella vaccine incorporated in the national childhood immunization programme for several years in Turkey, there are still unvaccinated women in childbearing age. We did not collect information on rubella vaccination and so the effect of rubella vaccination on rubella seropositivity could not be determined.

In this study, the seropositivities of the pregnant women for anti-CMV IgG, IgM and both IgG+IgM were 96.4 %, 0.7 % and 1.9 %, respectively. Seropositivities of CMV were reported in pregnant women as 39%-94.7% in USA^{33,34}, 56.8% in Australia³⁵, 30.4% in Ireland³⁶, 84% in Spain³⁷ and 100% in Thailand.³⁸ Several studies have reported between 84.5% and 95% prevalence of anti-CMV IgG among pregnant women in Turkey.^{21,22} CMV seroprevalence rates from published studies in daycare centre educators in the United States and Canada are 38%-67%.³⁹ CMV seroprevalence among women of childbearing age (15-44 years) in United States was reported as 58.3%. Many women in the United States enter their childbearing years susceptible to CMV infection. Large percentages of these women experience a primary CMV infection during their childbearing years.³³ For current prevention efforts, the CDC recommends counseling pregnant women about simple hygienic steps, such as hand washing, to decrease exposure to body fluids from young children (<http://www.cdc.gov/cmvi/index.htm>).⁴⁰

In conclusion, serologic screening before pregnancy is important to diminish morbidity and mortal-

ity caused by *T. gondii*, rubella and CMV. Although serological screening for TORCH agents among pregnant women, and follow-up examinations until delivery are routine procedures in Turkey, this care can not reach to all pregnant women because of different socioeconomical status. Widespread population screening may contribute to the prevention of congenital infections due to TORCH agents.

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