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Evaluation of *Toxoplasma gondii*, Rubella virus and Cytomegalovirus Infections

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ABSTRACT

Objectives: Primary infection agents occurring during pregnancy and causing congenital anomalies are *Toxoplasma gondii (T.gondii),* rubella virus and cytomegalovirus (CMV). It was revealed that these agents infected the fetus by crossing the placenta and increased the rate of fetal morbidity and mortality. This study aimed to investigate the relationship between seroprevalences of *T. gondii*, rubella virus and CMV antibodies.

Methods: The results were retrospectively evaluated. Pregnant women's serum samples sent to the Medical Microbiology Laboratory of Ankara Gülhane Training and Research Hospital between January 2018 and December 2018 were included in this study. *T. gondii*, rubella virus and CMV IgM and IgG antibodies were analysed using the chemiluminescent immunoassay method.

Results: In this study, the results of 647 pregnant patients were retrospectively analysed. The median age of the attendants was 28.0 (18.0-49.0) years. IgM positivities for *T. gondii*, rubella virus and CMV were found as 3 (0.6%), 3 (0.5%) and 61 (15.0%) respectively and IgG positivities were 66 (13.8%), 529 (91.7%) and 394 (99.3%), respectively.

Conclusion: In this study, the results were consistent with the findings obtained in the regional studies. Seroprevalence studies in pregnant women will be guide for the necessity of prenatal screening tests. Therefore, the findings suggest that pregnant women and women of childbearing age should be investigated concerning *T. gondii*, the rubella virus and CMV antibodies.

Keywords: Toxoplasmosis; rubella; cytomegalovirus; pregnant woman.

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INTRODUCTION

Toxoplasma gondii (T. gondii), rubella virus, cytomegalovirus (CMV) are the most common causes of congenital infections around the world.[1] While these agents cause asymptomatic or mild infections in pregnant women, primary infections occurring due to the agents crossing the placenta barrier in early pregnancy may cause congenital malformations, intrauterine growth retardation, spontaneous abortions, premature birth and fetal death.[2] Infection intensity depends on the age of pregnancy, virulence of the organism, and the severity of placental damage and maternal disease during the infection.[3] Infections related to these agents are the causes of morbidity and mortality especially in developing countries.[2]

T. gondii is a protozoan parasite spread by eating cat feces or contaminated soil or undercooked meat. Tropical regions in the world have the highest prevalence rate.[4] It is reported that fetal infection risk after infection is higher than 15% if she is infected in the 13th week

and higher than 70% if she is infected in the 36th week of the pregnancy.[5]

In primary infection caused by rubella virus in the first trimester, the risk for congenital rubella virus is the highest with a rate of 80-100%. This rate decreases to 10-20% in the second trimester while it increases again to 60% in the third trimester.[5]

CMV is the most common congenital viral infection agent in approximately 0.4-2.3% of live births.[6] While primary infection risk after vertical transmission is between 30% and 40%, this risk increases as the age of pregnancy increases, however, serious infections are observed in the early pregnancy infections.[6,7]

Prevalence of *T. gondii*, rubella virus and CMV infections differs according to the geographical regions. Data on serological conditions of the pregnant women regarding congenital infection agents provide information about the prevention of congenital infections based on these agents in women at risk.[8] It is hard to diagnose the infection with clinical findings because the infections in pregnancy are generally inapparent and asymptomatic. Therefore, the diagnosis is established by monitoring specific IgM antibodies or seroconversion in double serum sample.[9]

There are regional seroprevalence studies related to the seropositivity of these infections in Turkey. This study aimed to evaluate the seroprevalences of T.gondii, rubella virus and CMV infections in pregnant women presenting to our hospital and obtain regional epidemiological data.

METHOD

Pregnant women between the ages of 18 and 49 presenting to Gülhane Education and Research Hospital at the University of Health Sciences between January 2018 and December 2018 were included in this retrospective study. In serum samples sent with the diagnosis of pregnancy to the Medical Microbiology Virology Laboratory, *T. gondii*, rubella virus and CMV IgM and IgG antibodies were analysed by IgM and IgG commercial kits (Abbott, USA) with chemiluminescent microparticular enzyme immunoassay method in Architect system (Architect i2000SR, Abbott Diagnostics, USA). The results were evaluated according to the evaluation criteria of the kits. Index values according to the commercial kit were accepted as following: index value of <0.5 IU/mL is negative and ≥0.6 IU/mL is positive for T.gondii IgM, value of <1.6 IU/mL is negative and ≥3.0 IU/mL is positive for T.gondii IgG; index value of <1.2 IU/mL is negative and ≥1.6 IU/mL is positive for rubella virus IgM, value of <5 IU/mL is negative and ≥10 IU/mL index value of <0.85 IU/mL is negative and ≥1.0 IU/mL is positive for CMV IgM, value of ≥6 AU/mL is positive for CMV IgG.

Statistical Analysis

Based on the data collected in the study, SPSS 15 software (SPSS Inc, Chicago, IL, USA) was used for statistical evaluation. Frequency, percentage, median, minimum and maximum values were used from the descriptive statistics methods.

RESULTS

In this study, the results of 479 (74.0%) pregnant women for *T. gondii* IgM and IgG antibodies, 590 (91.2%) for rubella virus IgM and IgG antibodies and 407 (62.9%) for CMV IgM and IgG antibodies (647 pregnant women in total) were retrospectively evaluated. Median age of the attendants was 28.0 (18.0-49.0) years. IgM positivities for *T. gondii*, rubella virus and CMV were 3 (0.6%), 3 (0.5%) and 61 (15.0%) respectively and IgG positivities were 66 (13.8%), 529 (91.7%) and 394 (99.3%) respectively (Figure 1).

DISCUSSION

While most of the infections in pregnant women have the same importance with those in non-pregnant women, some infections may cause serious sequelae by transmitting especially in utero during pregnancy or to the baby during delivery. Laboratory findings are very crucial especially if the mother has mild disease or if the symptoms are not clear.[10] Prenatal screening of antibodies produced against infectious agents such as *T. gondii*, rubella virus and CMV is very crucial.[11]

T. gondii is a zoonotic protozoan parasite and its infection prevalence differs around the world according to geographical region, socioeconomic condition and cultural and religious beliefs of the population.[12] Prevalence rates differ between 10% and 80% among countries and also differ among different regions in the countries or different societies in the same region.[4] Prevalence rates were reported as 10-30% in North America, South East Asia, North

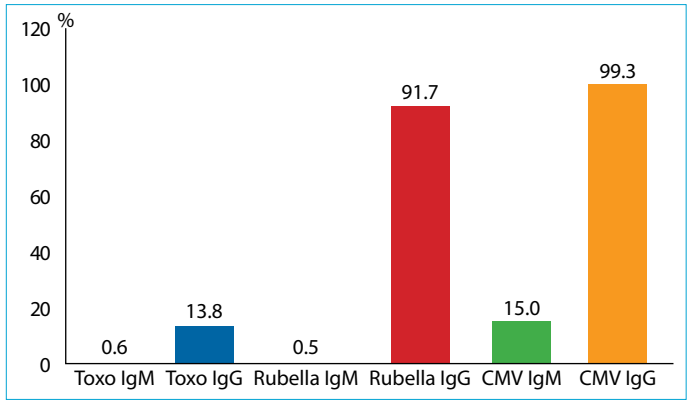

Figure 1. IgM and IgG seropositivity rates of Toxoplasma gondii, Rubella virus, CMV.

Europe and Sahelian countries of Africa, 30-50% in Middle and South European countries and higher prevalence rates were reported in Latin American and tropical African countries.[13]

In this study, *T. Gondii* IgM positivity of 0.6% was found consistent with the data in literature. When the seroprevalence studies on pregnant women in our country were evaluated, it was revealed that the highest seroprevalence rates were in South-eastern and Eastern Anatolia and the lowest rates were in Aegean region (Table 1).[14–27] In this study, T.gondii IgG seropositivity was 13.8%. This rate was found low according to the regional data.

Rubella virus infection is a disease that can be prevented by vaccine. It is crucial because the risk of being infected for fetus is high in active infection of sensitive pregnant women.[28] Rubella virus is held responsible for 2-3% of congenital anomalies caused by prenatal infection.[29] The distribution of rubella virus is worldwide. It was revealed that the sensitivity rate was between 10% and 25% in countries where immunisation efforts for rubella virus were the least.[30] When the studies on rubella virus seroprevalence in pregnant women in Turkey were evaluated, the lowest rubella IgG positivity with a rate of 86.6% was in Van and the highest seropositivity with a rate of 97.5% was in Isparta (Table 1).[14,17,20,22,23,28,31–36] In this study, rubella IgG seropositivity rate which is 91.7% was a little lower than that of regional data, however, it is consistent with overall data in our country. Our results reveal that there is a rubella virus-responsive pregnant with a rate of 8%. Moreover, rubella IgM positivity was found at a rate of 0.5% in this study.

Table 1. IgG seropositivity rates of Toxoplasma gondii, Rubella virus and Cytomegalovirus according to the geographic regions in Turkey

Geographic region	Infections	Seropositivity (%)
Marmara	Toxo IgG	23.6-50.0
	Rubella IgG	95.7
	CMV IgG	99.3
Black Sea	Toxo IgG	23.7-43.9
	Rubella IgG	93.8-98.3
	CMV IgG	91.5-99.5
Aegean	Toxo IgG	18.8-37.0
	Rubella IgG	89.5-95.1
	CMV IgG	90.4-99.0
Mediterranean	Toxo IgG	28.4-57.0
	Rubella IgG	93.2-97.5
	CMV IgG	93.4-99.3
Central Anatolia	Toxo IgG	26.9-36.9
	Rubella IgG	92.8-97.3
	CMV IgG	98.2-99.8
Eastern Anatolia	Toxo IgG	20.3-63.0
	Rubella IgG	86.6-96.2
	CMV IgG	99.5-100
Southestern Anatolia	Toxo IgG	34.9-68.9
	Rubella IgG	94.1
	CMV IgG	99.2

Toxo IgG: Toxoplasma gondi IgG; CMV IgG:Cytomegalovirus IgG

While CMV seroprevalence in developed countries is between 42.3% and 68.3%, this rate is higher in developing countries.[37] In studies on CMV IgG seropositivity rates in pregnant women in Turkey, the rate was generally more than 90% (Table 1).[14,20–21,23,28,32–35,38–40] In this study, while CMV IgG seropositivity was 99.3%, IgM seropositivity was 14.7%. These results reveal that most of the women of childbearing age face CMV before pregnancy. While single CMV IgM positivity was 0.5%, the rate of positivity was 14.7% with CMV IgG. These results suggest that most of the congenital CMV infections may be the result of recurring infection in pregnancy.

One of the limitations of the study is retrospective and the other limitation is the different patient numbers for each infection.

CONCLUSION

As a result, IgM positivity rates for *T. gondii*, rubella virus and CMV were 0.6%, 0.5% and 15.0% respectively and IgG positivity rates were 13.8%, 91.7% and 99.3% respectively. The results were consistent with those of regional studies. Seroprevalence studies in pregnant women will be guide for the necessity of prenatal screening tests.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Ethics Committee Approval: This study was performed with the approval of the Non-Interventional Clinical Research Ethical Committee of the University of Health Sciences Gülhane Training and Research Hospital (Approval date: 09.04.2019, Approval number: 2019/19/139).Since this study was retrospective, voluntary consent form could not be obtained.

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