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Cytomegalovirus and Toxoplasma Infections in Pregnant Women of Wu-Han Area

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In this study, we have investigated the prevalence of Human Cytomegalovirus (HCMV) and *Toxoplasma gondii* (*T. gondii*) infections among the pregnant women in Wu-Han, China. A total of 617 healthy women during their third to sixth month of pregnancies were studied and their antibody statuses to both HCMV and *T. gondii* were measured using the enzyme immunoassay methods. Among these pregnant women, 578 (93.7%) or 78 (12.6%) were positive in either IgG or IgM antibodies to cytomegalovirus. These results are higher than those studies performed in other developed countries. Since most of the newborn infections are possibly due to the direct infection from their re-infected mothers, therefore, it will be considerably important to establish a prevention program for the pregnant women. Similar studies have been conducted to investigate *T. gondii* infections in the same area. In this study, a very low *T. gondii* IgG positive rate (0.6%) was found. Indicating that the pregnant women in this area are vulnerable for *T. gondii* infections and consequently increased in the possibility for the direct maternal infections. Therefore, a proper prevention and treatment program should be implemented to avoid the possible *T. gondii* infections to the pregnant women in this area.

Key words: Cytomegalovirus, Toxoplasma

INTRODUCTION

Although genetic factors play the major roles in some congenital deficiencies, environmental factors are also believed to cause some newborn abnormalities[1-2]. Among these environmental causes, varied infections during the early pregnancy are the major factors contributed to the problems[3]. In this study, we have initiated a large scale of investigation to two of these possibly causing factors which might be impor-

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tant for the congenital disorders through maternal infections.

Previously, Wang and others[1-4] have clearly pointed out that HCMV infections are prevalently found among the general population. This virus is capable to penetrate placenta and cause the fetus infection. Since most of these infected mothers are usually mild or sub-clinical, it is difficult to diagnose HCMV infection during their routine checkup. Thus, the chance of fetus infections occurred in the maternal uterus should not be excluded. CMV in the congenitally infected newborn can result in generalized cytomegalic inclusion disease involving the liver, lung, brain and blood-forming organs, which include microcephalus, premature[5], hearing impairment, and mental retardation[6]. Other complications in newborn, such as jaundice, purpura, and hernia are also associated with the infections[6]. Furthermore, Leonard *et al.* has reported that infected mothers might deliver a baby with a low birth weight (<1250 gm)[7].

On the other hand, *T. gondii* infections are found in both human and animals. Although varied infection rates of the organism were observed in different locations as well as in the different populations, it is believed that *T. gondii* infection is largely associated with some animal carriers. The *T. gondii* infections are probably related to consume the not well-cooked meats contaminated by the microorganisms. The developing fetus and immunocompromised individuals are most vulnerable to infection with *T. gondii* [8]. Most of these infections to healthy individuals are asymptomatic, however, severe damages to central nervous system and eyes have been reported[8]. Infections to pregnant women, on the other hand, may result in the consequences of blindness, mental retardation, neurologic deficits, and deafness in their newborns[9]. Furthermore, intrauterine growth-retarded fetuses, abortion, intrauterine fetal death, congenital malformation and stillbirth have been previously described in those *T. gondii* infected pregnancies [2,10-13].

In order to prevent the maternal infections caused by these two genetically unrelated organisms, we have launched this large scale of investigation to both HCMV and *T. gondii* infections in Wu-Han, China. We believe that this work is not only valuable scientifically, but also useful for the local health care authority to establish a suitable prevention program for pregnant women to against these infections.

METHODS

A total of 617 pregnant women, who were registered to the Wu-Han regional health clinics and who were in their twenties and thirties, were subjected to this study from October, 1989 to June, 1990. Venous blood withdrew from these individuals were used for the sera preparation by several centrifugations of the clotted blood samples. The final sera were frozen at -70 ℃ until use. sera IgG and IgM antibodies to HCMV or sera IgG antibodies to *T. gondii* were determined using enzyme immunoassay (EIA) methods (Abbott Laboratories) and the absorbance values of the samples were measured spectrophotometrically at a wavelength of 492 nm. In each of these assays, a positive result was granted following the criteria for each assay suggested by manufactory. As described previously[14-16].

RESULTS

A total of 617 pregnant women were tested throughout this study period. As shown in Table 1, 93.7% of the test sera displayed positive IgG reactivities to cytomegalovirus while only a 12.6% showed IgM antibodies to the same virus. On the other hand, only 0.6% of the tested sera

were found positive in IgG antibodies to *T. gondii* (Table 2).

DISCUSSION

Although many fetus and newborn infections, especially the viral and parasitic infections are asymptomatic as their infected mothers, however, the congenital abnormalities are sometime associated with the infections. Hence, it should be worthy of further investigations of the viral and parasitic infectious statuses among the pregnant women in order to prevent the newborn abnormalities. Among the viral infections, the cytomegalovirus infection is found worldwide and infection rate is largely associated with the geological locations, races and other social-economic conditions[17]. Previous reports have indicated that the infections are higher in developing countries than those of developed countries as well as are more susceptible to those people lived in property[1,18-20]. Consten *et al.*[21] reported that 50% to 60% of middle-class pregnant women carried reactive antibodies to the virus, whereas the antibodies were found in 70% to 85% of pregnant women from lower social-economic classes. Suggesting that the social-economic factors do play a significant role for the viral infection.

Studies of 917 clinical asymptomatic pregnant women, Bos *et al.* found that pregnant women with cytomegalovirus IgM antibodies were most likely to deliver babies with jaundice or even dead babies within a few days of birth [22]. In some of these cases, the congenital defects were found and were possibly associated with the chronic viral infections of the mothers. Fetuses are possible infected by their previously infected mothers under certain circumstances[3], although most of these infections might be asymptomatic[23-24]. Zhong *et al.* has described that miscarriage, congenital malformation, stillbirth, premature fetal death and intrauterine growth retardation were found higher in the HCMV-IgM positive pregnant women than those women without HCMV-IgM antibodies[25]. Furthermore, the rates for congenital malformation, stillbirth, premature fetal death, and intrauterine growth retardation (IUGR) and other neonatal abnormalities were all apparently higher in the HCMV-IgM positive pregnant group than in the HCMV-IgM negative group[25]. These results have indicated a causal relationship between HCMV infection in pregnant women and the newborn abnormalities.

In this study, we investigated the healthy pregnant women who were in their twenties and thirties and in their first three to six months of pregnancies. A total of 617 individuals were identified and subjected to this study. By using the EIA assays to detect the HCMV antiserum, we found 93.7% and 12.6% of the total tested sera carried IgG and IgM antibodies to HCMV, respectively (Table 1). These results of HCMV-IgG antibody are similar to those previously reported by Wang *et al.* and Rodier *et al.*[6, 26]. However, a lower HCMV-IgM positive rate was found among pregnant women in a similar study to another major city in China[6]. Indicating that HCMV infections to pregnant women were prevalent in our study region. And thus, a high occurrence of intrauterine viral infections is expected in the Wu-Han area. Therefore, we suspect that the congenital HCMV infections in newborns found in Wu-Han area are possibly due to the maternal infections of the virus during their pregnancies.

To prevent the newborn HCMV infection, it should be important to eliminate the viral transmission from the maternal HCMV. A well established health education should be implanted as well as the removal of the transmission sources. Other than that, an immunity to the viral infection in the pre-pregnant women is another critical factor for the prevention. Al-

though it is known that HCMV antibody carrying pre-pregnant women need no further viral or serological examination[27-28], however, routinely check up during the pregnancy should be considerably important for the early detection. To any possible HCMV infected pregnancy, proce-

Table 1. Anti-Cytomegalovirus IgG and IgM among pregnant women in Wu-Han area

	Tested samples	positive (%)	negative (%)
IgG antibody	617	578 (93.7%)	39 (6.3%)
IgM antibody	617	78 (12.6%)	539 (87.4%)

Table 2. Anti-*Toxoplasma gondii* IgG among pregnant women in Wu-Han area

	Tested samples	positive (%)	negative (%)
IgG antibody	617	4 (0.6%)	613 (99.4%)

Table 3. Summary of the occurrence rates of anti-*Toxoplasma gondii* IgG in different studies

Study areas		Sample Number	IgG Positive	Ratio (%)	IgG Negative	Ratio (%)
Wu-Han, Hu-Pei area		617	4	0.6	613	99.4
Taiwan (10)	Taipei City	766	73	9.5	693	90.5
	Taipei County	726	73	9.5	651	89.7
	Taoyuan and Hsinchu Counties	141	14	9.9	127	90.1
	Taichung, Nantou and Changhua Counties	140	11	7.9	129	92.1
	Chang-bin, Taitung County	23	10	43.5	13	56.5
Taipei, Taiwan (29)		265	25	9.4	240	90.6
Catania: Sicily (13)		936	377	40.3	559	59.7
Republic of Benin (26)		108	52	48.1	56	51.9
Republic of Slovenia (8)		2651	1309	49.4	1342	50.6

dures such as serological examination, prenatal ultrasonographic diagnosis, preventive inoculation, routine prenatal examination and treatment of the HCMV infection should be seriously taken into consideration by clinical physicians for the prevention of this viral infection. Hence, the newborn HCMV infection should be eliminated.

The *T. gondii* infections among the pregnant women were also investigated in the same study (Table 2). By using the EIA assays, we found that the positive antibody detection rate for *T. gondii* is lower in our study than previous reports[8,10,13,26,29]. As shown in Table 3, when compared our results with other available information, a significantly decreased in *T. gondii* antibody were found among the pregnant women living in the different regions. Especially in those studies done by Yu *et al.* have clearly demonstrated that women of Han origin have a low *T. gondii* antibody positive rate than those of native Taiwanese in the same study area[10]. Indicating that the cultural and environmental factors are significantly important to the *T. gondii* infections. Among these differences, the eating habit, particularly the meat consuming, is the most likely factor contributes to the different occurrences of early *T. gondii* infections in different regions. As we have found in Wu-Han area, foods are all well cooked by either boiling or frying. The possible transmission sources of *T. gondii* are eliminated during the food preparation, since the oocysts of the organisms are susceptible to the heat treatment.

Primary infection of *T. gondii* in pregnant women could result in the congenital infections to the newborns. Since we found a low *T. gondii* antibody positive rate in Wu-Han area, it will be necessary to prevent the *T. gondii* infections to the pregnant women during their pregnancies especially to those without the immunities. To do so, suitable food preparation procedures to get rid of the organisms will be essential for the prevention of the infection. In order to efficiently eliminate the oocysts of *T. gondii* from daily foods, we suggest a frozen procedure for any meat preparation before cooking as previously described[30]. Through this simple procedure, the viability of the organisms should be very low and the incidence for the infection should be limited. Other than that, a good health education as well as a good personal hygiene would be important to establish especially to those pregnant women. Furthermore, the serological detection of *T. gondii* infection should be necessarily added to the routine check up for pregnant women during their pregnancies. If all these prevention procedures are seriously taken, then the newborn infections of *T. gondii* will be unlikely.

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孕婦與巨細胞病毒及弓漿蟲感染之調查研究

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在此研究中，爲瞭解湖北省武漢地區孕婦受巨細胞病毒及弓漿蟲感染的情形，我們以酵素免疫分析法，檢查617位懷孕三個月至六個月健康孕婦的巨細胞病毒及弓漿蟲的抗體。結果發現巨細胞病毒IgG抗體陽性者在617位孕婦中有578人佔93.7%，IgM抗體陽性者有78人佔12.6%。其結果，顯示武漢地區孕婦對巨細胞病毒抗體IgG及IgM之陽性率均高於已開發國家，新生兒的先天感染，主要可能是由受感染的孕婦垂直感染引起。所以對懷孕婦女建立預防計畫是很重要的。

在同樣地區也用同樣方法研究弓漿蟲感染。在這研究中，發現弓漿蟲IgG抗體陽性率非常低（0.6%），顯示這地區孕婦容易受弓漿蟲的感染，自然地也就增加母體垂直感染的可能性。所以應該實施適當地預防及治療計畫，避免此地區孕婦感染弓漿蟲的可能性。