

Detection of *Toxoplasma gondii* IgM and Cytomegalovirus IgM antibodies among blood donors in Mosul

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ABSTRACT

Background: Toxoplasmosis is an infection caused by the protozoan parasite *Toxoplasma gondii*. This parasite can be transmitted via blood transfusion. Cytomegalovirus (CMV) is a herpes virus that can cause many complications and mostly transfer via blood transfusion. The aim of this study was to evaluate the percentage of risk of infections that could occur due to blood transfusion.

Subjects and methods: Ninety blood donor samples were randomly obtained from central blood bank of Mosul city and investigated for IgM of toxoplasmosis and CMV by the serological method ELISA, IgM.

Results: ELISA test for *Toxoplasma gondii* IgM test showed 3% seropositive and for CMV showed 10% seropositive.

Conclusion: The results indicate a risk of infection with toxoplasmosis and CMV via blood transfusion.

Keywords: *Toxoplasma gondii*, *Cytomegalovirus*, blood donors, IgM.

الخلاصة

الخلفية: داء المقوسات هو خمج يتسبب به طفيلي أحادي الخلية يعرف بالمقوس الكوندي ويمكن لهذا الطفيلي ان ينتقل عن طريق نقل الدم. و رشح CMV هو من عائلة القوبائيات و يسبب العديد من المضاعفات و ينتقل عن طريق الدم غالبا و سوائل الجسم الأخرى. كان الهدف من هذه الدراسة تقييم نسبة الخطورة لحدوث اصابات جديدة بسبب انتقال العدوى عن طريق نقل الدم.

طريقة العمل: تم اختيار ٩٠ عينة عشوائية من متبرعين بالدم في مصرف الدم المركزي في مدينة الموصل و اختبار مستوى المستضد المناعي من نوع M لداء المقوسات و رشح CMV بطريقة اليزا الغلوبين المناعي M. **النتائج:** اظهر اختبار اليزا للمستضد المناعي نوع M لداء المقوسات نسبة ٣% نتيجة موجبة و اظهر لرشح CMV نسبة ١٠% نتيجة موجبة.

الاستنتاج: نتائج البحث تعطي مؤشر عن وجود خطورة التعرض للإصابة بداء المقوسات و رشح CMV عن طريق نقل الدم.

T*oxoplasma gondii* is a coccidian protozoan of worldwide distribution¹. Researches showed that up to one-third of world's population are infected with *toxoplasma gondii*^{1,2}. Most infections in immune competent individuals are asymptomatic and in

some of infected individuals will have one or more of the following symptoms: cervical lymphadenopathy or ocular disease occur in up to 10% of infected individuals². Fever, a vague ill feeling and sometimes sore throat, blurred vision, and eye pain³. Severe

infection usually develops only in fetuses, which results in congenital toxoplasmosis^{2,5}, and in immune compromised patients⁴, which could result in CNS disease as encephalopathy or brain abscess^{2,6}.

The mode of transmission of *Toxoplasma gondii* to human can happen by ingestion of food or water that is contaminated with oocyst shed by cats; also by eating of undercooked or raw meat containing tissue cyst^{2,6,7} or by transplantation and blood transfusion⁸⁻¹¹.

Since *Toxoplasma gondii* organisms retain their viability after suspension in citrated blood and storage at 5 °C for up to 50 days¹² and since *Toxoplasma gondii* have been recovered from the buffy coat of patients with toxoplasmosis¹³, it appears likely that toxoplasmosis could be acquired in this fashion, particularly if large concentrations of leukocytes are given from donors who, themselves, are likely to be infected with *Toxoplasma gondii*¹².

Human Cytomegalovirus (CMV) is a herpes virus which is globally distributed in human population. Although rarely pathogenic in immunocompetent individuals, the virus possess a significant health threat to immunocompromised individuals and is a significant cause of morbidity and mortality especially in organ allograft and bone marrow transplant patients^{14,15}.

Traditionally, congenital CMV disease is known to be the most serious, but prenatal and postnatal acquired infections are also an important cause of morbidity in

infants. Humans are believed to be the only reservoir for human CMV, and natural transmission occurs by direct or indirect, close or intimate person-to-person contact. Sources of virus include oropharyngeal secretions, urine, cervical and vaginal excretions, semen, breast milk, tears, feces, and blood^{16,17}.

CMV is intracellular virus could be localized in leukocytes and detected by monoclonal antibodies or genetic probes; CMV is concentrated in neutrophil fraction of the buffy coat, rather in the mononuclear fraction¹⁷. The host immune response presumably maintains CMV usually remains in a latent state in seropositive individuals and reactivation is more frequent in immune compromised patients than in normal hosts, although usually reactivated infections may be less severe and virulent than primary infections³.

Many studies evaluated the risks associated with blood transfusion were conducted in Saudi Arabia, Turkey, Mexico, USA, Thailand, Nigeria and Iraq as well²⁵⁻³⁵, yet this study represent one of the first trails in Mosul city. This study aimed to determine the risk of toxoplasmosis and CMV transmission due to blood donation process.

Materials and methods

The samples were randomly collected as 30 samples every 2 months in three different periods between December 2007 and May 2008, (total 90 samples) from central blood bank in Mosul city. All samples were taken from male donors (majority of donors were male)

aged between 20 to 62 years (mean \pm SD: 33.3 \pm 8.73 years); The donors were apparently healthy.

The samples were tested for HIV and Hepatitis B and C in the bank laboratory. Blood is neglected and destroyed for positive result of HIV and Hepatitis. The samples were taken after exclusion the HIV and Hepatitis and analyzed for anti *Toxoplasma gondii* IgM antibodies and CMV IgM antibodies by using *Toxoplasma gondii* IgM enzyme linked immunosorbent assay ELISA method¹⁸⁻²¹ (Biocheck inc. Canada) and CMV IgM enzyme linked immunosorbent assay ELISA method²²⁻²⁴ (Biocheck inc. Canada).

The ELISA test was done by serum dilution 1:40, enzyme conjugate addition, TMB reagent then stop solution is added, read at 450 nm in ELISA reader for both *Toxoplasma gondii* IgM and CMV IgM. The results

were calculated for each determination by referring the value to the cut-off value reading of the used kit.

The data presented as percentage, Z-test was used to test proportion from zero, $p < 0.05$ was considered significant.

Results

Enzyme linked immunosorbent test (ELISA) revealed three cases of active toxoplasmosis and the remaining are negative results as seen in table 1.

ELISA IgM test revealed 10 seropositive of CMV out of 90 serum samples as shown in table 1.

The infection with toxoplasmosis and CMV were compared with the time of sample collection as shown in table 2.

The total and seropositive samples are distributed according to the donor residence as urban or rural donors as shown in table 3.

Table 1. *Toxoplasma gondii* and CMV IgM ELISA test results for the selected samples (n=90)

Test/ Group	Positive	Negative	Total	P value
<i>Toxoplasma gondii</i> IgM	3 (3.4%)	87(96.6%)	90(100%)	NS*
CMV IgM	10 (11.11%)	80 (88.88%)	90 (100%)	<0.01

*NS: Not significant.

Table 2. Time distribution of *Toxoplasma gondii* and CMV infection (months of collection)

Infection/ groups	1 st group n=30 (DEC.-JAN)	2 nd group n=30 (FEB- MAR)	3 rd group n=30 (APR-MAY)
CMV	3	3	4
<i>Toxoplasma gondii</i>	2	1	0

Table 3. Urban- rural distribution of total and seropositive samples

samples	locality		Total
	urban	rural	
Collected samples	N=56 (62.2%)	N=34 (37.7%)	N=90 (100%)
<i>Toxoplasma gondii</i>	N=2 (67.7%)	N=1 (33.3%)	N=3 (3.4%)
CMV	N=8 (80%)	N=2 (20%)	N=10 (11.11%)

Discussion

Toxoplasma gondii parasite is able to parasitize peripheral blood leukocytes²⁵ as well as tissue leukocytes. Human studies demonstrate that there is parasitemia caused by *Toxoplasma gondii* in asymptomatic blood donors and in women who delivered congenitally infected infants¹⁵.

The risk of acquiring *Toxoplasma gondii* via blood transfusion was estimated by this study as about 3% of donated samples are able to transmit *Toxoplasma gondii*, and such result is in accordance with a study made by Sundar *et al.*²⁷ in India which showed 3.6% were seropositive for *Toxoplasma gondii* IgM²⁷, and with other study conducted in Saudi Arabia by Al-Harthi SA *et al.*²⁸ showed there were 5.6% seropositive for *Toxoplasma gondii* IgM, , in the other hand a study in Mexico by Alvarado-Esquivel *et al.*¹² revealed that there is

about 1.9% of *Toxoplasma gondii* IgM seropositive in there locality which is relatively lower than the results of this study, such percent variance could be due to differences in climatic conditions, culinary habits and exposure to the sources of infection²⁹, and also supported by Bobic *et al.*³⁰ and Logar *et al.*³¹ who indicated a significant changes in infection rate by seasons and climate temperature.

The results of Cytomegalovirus IgM in this study is comparable to Henle *et al.*³² who estimated that 5-10% of blood donors are CMV IgM seropositive, and also to a study conducted by Amarapa P *et al.*³³ in Thai who also estimate the CMV IgM 10.6% and it is relatively much lower than a study conducted in Nigeria³⁴ which showed 19.5 % CMV IgM seropositive results among blood donors, while the results in this study is much higher than the results of a study conducted by Chaudhari S *et al.*³⁵ in India who revealed only 1.6% were

CMV IgM seropositive, such variance could be due to seasonal changes especially humidity degree as explained by Chan VF et al³⁶ and this is in consistence with results of this study which showed increment in CMV IgM level with rise in temperature and humidity.

The donated blood is given to patients with many acute conditions and the majority of them are immune compromised and they at a higher risk of acquiring infection with these microorganisms, and since both microbes can still be localized in leukocytes even if the donors are signs free, the risk of transmission still represents a biohazard problem.

In conclusion the risk of toxoplasmosis and CMV transmission represents 3% and 10% respectively of donated blood at the research period.

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