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Seroprevalence of cytomegalovirus infection among pregnant women at Omdurman Maternity Hospital

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This study was conducted to determine the seroprevalence of human cytomegalovirus (HCMV) among pregnant women at Omdurman Maternity Hospital between the period January 2009 and June 2009. Descriptive cross-sectional study was conducted in Omdurman Maternity Hospital; blood was taken from pregnant women that came for delivery and investigated for cytomegalovirus specific immunoglobin G (IgG) and immunoglobin M (IgM) antibodies using enzyme-linked immunosorbent assay (ELISA). Demographic and clinical data were collected by questionnaire after a written consent. A total of 200 pregnant women were included in this study. The ages of all women tested ranged from 18 to 43 years. Out of the 200 pregnant women tested, 195 (97.5%) and 12 (6.0%) were CMV IgG and CMV IgM positive, respectively. The age was associated with CMV IgM and history of miscarriage was significantly associated with CMV IgG positive women, while parity, congenital abnormalities, educational level, and occupation were not significantly (P > 0.05) associated with CMV infection.

Key words: Seroprevalence, human cytomegalovirus (HCMV), pregnant women.

INTRODUCTION

The human cytomegalovirus (HCMV) or human herpes virus 5 is one of the major causes of congenital infections (Kenneson and Cannon, 2007; Dollard et al., 2007; Cannon, 2009; Munro et al., 2005; Sotoodeh et al., 2010). Its clinical manifestations range from asymptomatic forms (90% of cases) to severe fetal damage, and in rare cases, death due to miscarriage. Furthermore, 10 to 15% of the children who are asymptomatic at birth may develop late sequelae, especially hearing defects, after a period of months or even years (Massimo et al., 2009).

HCMV can be transmitted via saliva, sexual contact, placental transfer, breast feeding, blood transfusion and solid-organ transplantation (Bowden, 1991). Latency following a primary infection may be punctuated by periodic reactivations that give rise to recurrent infections, and *in utero* transmission may occur during either primary or recurrent infections. Although the mechanisms and the pathogenesis of intrauterine transmission and severe fetal infection in the presence of preexisting maternal immunity are unknown, an analysis of CMV strain-specific antibody responses revealed an association between intrauterine transmission of CMV and reinfection with new or different virus strains in sero-immune women (Bappona, 2001), but it is likely that most recurrent infections are due to reinfection. The risk of congenital infection is much higher during primary infection (Fowler and Boppana, 2006). It has been reported that the risk of fetal damage is greater if the primary infection occurs during the first trimester of pregnancy (Adler and Marshall, 2007).

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CMV is a slow replicating virus from the herpes family, infecting only as many as 1% of all neonates in developed countries, but demonstrating up to 90% immunoglobin G (IgG)-positivity in developing countries (Cannon, 2010). As well as increasing with age, CMV seroprevalence may also depend on sexual activity and occupation, particularly occupations involving close contacts with children in a community setting. In the case of parents, contact with the urine or saliva of their children is a major source of infection (Adler, 1991).

CMV is the most common and serious congenital infection, because it occurs after both primary and recurrent infection in pregnancy and is a major cause of childhood deafness and neurological handicap (Nigro, 2009, Colugnati et al., 2007).

High CMV seroprevalence (98.3%) among pregnant women was reported (Nahla et al., 2011). Previous study conducted at Omdurman Maternity Hospital revealed that the seroprevalence of CMV IgG antibodies among pregnant women was 95% (Kafi et al., 2009). A recent study conducted at El-Rahad hospital in Western Sudan reported that the seroprevalence of CMV among pregnant women was 72.2 and 2.5% for CMV IgG and CMV immunoglobin M (IgM), respectively (Hamdan et al., 2011).

Various other unpublished observations emphasize the clinical importance of CMV infections among pregnant women and its detrimental consequences to their infants in Sudan; however, work on IgM and its association with congenital anomalies of neonates is very scares, this study was intended to know the magnitude of this problem in Sudan and to know if there is a need for vaccination.

MATERIALS AND METHODS

This is a descriptive cross-sectional study conducted in Omdurman Maternity Hospital between January 2012 and June 2012. A total of 200 pregnant ladies attending the hospital were selected randomly from all women that came for delivery during the study period. Omdurman Maternity Hospital is the biggest maternity hospital in Khartoum. Khartoum is the capital of Sudan with an area of 28.140 km^2. The total population is about 6000000. It is divided into three provinces: Khartoum, Omdurman and Bahary. The hospital serves population of these provinces; area around Khartoum and in addition to referred patients from other states of Sudan, total deliveries was about 27000 in 2011. A total of two hundred venous blood samples were collected. The blood samples were collected under aseptic conditions, allowed to clot, centrifuged at 3000 rpm for 5 min, and sera were collected in sterile containers and stored at -40°C until tested. The Enzyme-Linked Immunosorbent Assay (ELISA) was used to detect the specific HCMV IgG and IgM antibodies. A well constructed questionnaire was filled by the investigator; a written consent was obtained from all the women that participated.

RESULTS

Overall prevalence of anti-CMV IgG antibodies in pregnant women attending Omdurman Maternity Hospital for delivery was 97.5%. 195 women out of 200 women studied were positive for CMV IgG, while only 6% were CMV IgM positive. The results showed that the highest anti-CMV IgG seropositivity rate was among those with 40 years and more, while the lowest rate was among women less than 20 years old (Table 1).

CMV seropositivity was analyzed with respect to parity. No statistically significant difference was found between primigravidas and multiparous women on CMV infection (Table 2). Out of the 195 women who were CMV IgG positive, 8 women (4.2%) were reported on having child with congenital abnormalities, while no one from the negative group was reported on having congenitally formed child. In this study, no significant difference ($P > 0.05$) was found between working and non working women in CMV seropositivity (Table 3). The study demonstrates that the level of education of pregnant women had no effect on CMV seropositivity (Table 4).

DISCUSSION

This study revealed that the prevalence of CMV in pregnant women is very high, anti-CMV IgG antibodies was found in 97.5% of the cases, while 6% of the subjects tested positive for anti-CMV IgM.

The detection of CMV IgG indicated that the pregnant women had previously been infected with CMV. After CMV infection, IgG remains in the body for life and protects considerably against the next infections. This indicates that a negative results of CMV IgG test means that the women have not been infected with the virus.

The seroprevalance of CMV IgG observed in this study was similar to the results reported in Sudan by Nahla et al. (2011) which was 98.3% and Kafi et al. (2009) which was (95%). The picture of CMV prevalence in different countries is almost similar to our results; 96% in Egypt (El-Nawawy et al., 1996), 97.2% in Nigeria (Akinbami et al., 2011), 97.3% in Turkey (Uyar et al., 2008), 98.1% in Korea (Seo et al., 2009), and 95.6% in China (Meng et al., 2011). However, the results of this study were higher than those reported by Picone et al. (2009) in France (46.8%), Alanen et al. (2005) in Finland (56.3%), and Staras et al. (2006) in the United State (60.0%). It seems that the prevalence of CMV infection observed in this study was similar to that reported in other developing communities but higher than in the developed communities. This may be attributed to the low socioeconomic status and poor hygienic practices which might play important roles in increasing the rate of CMV infection. It was previously documented that seroprevalence of CMV among women varies with geographical location, socioeconomic status and occupation (Awosere et al., 1999).

In the present study, the rate of positive CMV IgM was 6.0% among tested pregnant women, which reflected an active recent infection or reactivation of the virus. This finding was higher than that of Hamdan et al. (2011) in Western Sudan who reported the rate of positive CMV

Table 1. Distribution of CMV seropositive women according to age group.

Age group (Years)	No. tested	Anti-CMV IgG positive		CMV IgM positive	
		No.	%	No.	%
>20	38	36	94.7*	2	5.2
20-29	78	76	97.4	4	5.1
30-39	74	73	98.6	3	4
≥ 40	10	10	100	3	30
Total	200	195	97.5	12	6

CMV: Cytomegalovirus.

Table 2. The effect of frequency of parities on CMV IgG and IgM seropositivity among pregnant women.

Serological marker (Anti-CMV antibodies)			Frequency of parities			
			1 time	2 times	3 times	< 3 times
Anti-CMV IgG	Positive	Frequency	62	38	21	74
		%	31.0	19.0	10.5	37.5
	Negative	Frequency	2	2	1	0
		%	1.0	1.0	0.5	0.0
Anti-CMV IgM	Positive	Frequency	2	3	3	4
		%	1.0	1.5	1.5	2.0
	Negative	Frequency	62	38	22	66
		%	31.0	19.0	11.0	32.0

CMV: Cytomegalovirus.

Table 3. Distribution of CMV seropositive women according to occupation, history of abortion and history of congenital anomaly baby.

Variable	CMV IgG positive	CMV IgG negative	Comment
Occupation			
Workers (%)	110 (56.4)	2 (40)	
Not workers (%)	85 (43.6)	3 (60)	
Congenital anomaly			
Yes (%)	8 (4.2)	0	
No (%)	187 (95.8)	5 (100)	
History of miscarriage			
Yes (%)	20 (10.2)	0	
No (%)	175 (89.8)	5 (100)	

IgM as 2.5%; however, far higher CMV IgM seroprevalence (94.3%) in neonates was recently reported in Sudan (Nahla et al., 2011). Variable IgM positivity were reported worldwide, only 1.0% in Turkey (Uyar et al., 2008), 2.5% in Iran (Bagheri et al., 2012) and 1.7% in Korea (Seo et al., 2009). However, the findings of this study were in agreement with that obtained by Saraswathy et al. (2011) in Malaysia (7.2%), but lower than that reported by Arabzadeh et al. (2005) in Iran (33 %) and Lone et al. (2004) in Kashmir valley (15.98%).

Our study showed a significant association ($P < 0.05$) between the history of miscarriage and CMV IgG seropositivity, and this may be due to infection by CMV earlier in reproductive live causing miscarriage.

In this study, a significant association ($P < 0.05$) was found between the age of pregnant women and CMV IgM seropositivity. Majority of CMV IgM positive women were above 30 years of age. This finding agreed with the

Table 4. Anti-CMV IgG seropositivity rate by educational levels.

Educational level	No. tested	Anti-CMV IgG positive	
		No.	%
Illiterate	18	18	100
Primary school	85	84	98.8
Intermediate school	44	43	97.7
Secondary school	47	46	97.8
High education	6	6	100
Total	200	195	-

results of Bate et al. (2010) in the United States. However, our finding disagreed with the results obtained by Hamdan et al. (2011) in Western Sudan, which could be attributed to the difference in the mean of age for tested women. According to this finding, pregnant woman above 30 years of age were at higher risk of CMV infection.

In this study, the parity, gestational age, congenital abnormalities, educational level, residence and occupation were not significantly ($P > 0.05$) associated with CMV infection among pregnant women. However, other authors reported significant association of these risk factors to CMV infection among pregnant women (Hamdan et al., 2011; Bagheri et al., 2012). The fact that there were no differences related to the age of the women indicates the same behavior at different ages.

The findings of our study indicated high prevalence of CMV seropositivity among pregnant women at Omdurman Maternity Hospital. Furthermore, the results showed that maternal age was a main risk factor for CMV reinfection or new infection. IgG avidity test should be used to distinguish primary and recurrent infection, and polymerase chain reaction (PCR) is essential for accurate diagnosis of CMV infection. CMV infection may play an important role in miscarriage. Introduction of national screening and immunization is a matter of discussion especially in areas with high prevalence of IgG and poor countries like Sudan.

REFERENCES

Adler SP (1991). Cytomegalovirus and child day care: risk factors for maternal infection. Pediatr. Infect. Dis. J. 10(8):590-594.

Adler SP, Marshall B (2007). Cytomegalovirus infections. In: Pediatrics in Review. J. Am. Acad. Pediatr. 28(3):92-100.

Akinbami AA, Rabiu KA, Adewunmi AA, Wright KO, Dosunmu AO, Adeyemo TA, Adediran A, Osunkalu VO (2011). Seroprevalence of cytomegalovirus antibodies amongst normal pregnant women in Nigeria. Int. J. W. H. 3:423-428.

Alanen A, Kahala K, Vahlberg T, Koskela P, Vainionpää R (2005). Seroprevalence, incidence of prenatal infections and reliability of maternal history of varicella zoster virus, cytomegalovirus, herpes simplex virus and parvovirus B19 infection in South- Western Finland. BJOG: Int. J. Obstet. Gynecol. 112(1):50-56.

Arabzadeh AM, Mosavat SA, Eftekhari N (2007). Seroepidemiology of Human Cytomegalovirus in pregnant women in Keman City during 2005. J. Kerman Univ. Med. Sci. 14(4):279-288.

Awosere KE, Arinola OG, Uche LN (1999). Hepatitis B Virus Seroprevalence among pregnant woman in University College Hospital, Ibadan. J. Med. Lab. Sci. 8:77-82.

Boppana SB, Rivera LB, Fowler KB, Mach M, Britt WJ (2001). Intrauterine Transmission of Cytomegalovirus to Infants of Women with Preconceptional Immunity. N. Engl. J. Med. 344:1366-1371.

Bagheri L, Mokhtarian H, Sarshar N, Ghahramani M (2012). Seroepidemiology of cytomegalovirus infection during pregnancy in Gonabad, east of Iran: a cross-sectional study. J. Res. Health Sci.12 (1):38-44.

Bate SL, Dollard SC, Cannon MJ (2010). Cytomegalovirus sero-prevalence in the United States: the National Health and Nutrition Examination Surveys, 1988-2004. Clin. Infect. Dis. 50(11):1439-1447.

Bowden RA (1991). Cytomegalovirus infection in transplant patients: methods of prevention of primary cytomegalovirus. J. Transplant Proc. 23:136-138.

Cannon MJ (2009). Congenital cytomegalovirus (CMV) epidemiology and awareness. J. Clin. Virol. 46:6-10.

Cannon MJ, Schmid DS, Hyde TB (2010). Review of cytomegalovirus seroprevalence and demographic characteristics associated with infection. Rev. Med. Virol. 20(4):202-213.

Colugnati FAB, Staras SAS, Dollard SC, Cannon MJ (2007). Incidence of cytomegalovirus infection among the general population and pregnant women in the United States. BMC Infect. Dis. 1471-2334,7-71. P

Dollard SC, Grosse SD, Ross DS (2007). New estimates of the prevalence of neurological and sensory sequelae and mortality associated with congenital cytomegalovirus infection. Rev. Med. Virol. 17:355-363.

El-Nawawy A, Soliman AT, El Azzouni O, Amer El-S, Karim MA, Demian S, El Sayed M (1996). Maternal and neonatal prevalence of toxoplasma and cytomegalovirus (CMV) antibodies and hepatitis-B antigens in an Egyptian rural area. J. Trop. Pediatr. 42(3):154-157.

Fowler KB, Boppana SB (2006). Congenital cytomegalovirus (CMV) infection and hearing deficit. J. Clin. Virol. 35:226-231.

Hamdan ZH, Abdelbagi IE, Nasser NM, Adam I (2011). Seroprevalence of cytomegalovirus and rubella among pregnant women in western Sudan. Virol. J. 8:217-220.

Kafi SK, Eldouma EY, Saeed SBM, Musa HA (2009). Seroprevalence of Cytomegalovirus among blood donors and antenatal women attending two hospitals in Khartoum State. Sudan J. Med. Sci. 4(4):399-401.

Kenneson A, Cannon MJ (2007). Review and meta-analysis of the epidemiology of congenital cytomegalovirus (CMV) infection. Rev. Med. Virol. 17:253-276.

Lone R, Fomda BA, Thokar M, Wani T, Kakru D, Shaheen R, Nazi A (2004). Seroprevalence of cytomegalovirus in Kashmir valley. J K Practitioner. 11(4):261-262.

Massimo D, Carlo A, Maria TM, Alessia P, Pierangelo C (2009). Incidence and Risk of Cytomegalovirus Infection during Pregnancy in an Urban Area of Northern Italy. J. Infect. Dis. Obstet. Gynecol. 1-5.

Meng Li-li, Chen H, Tan JP, Wang Zheng-hua, Zhang R, Fu S, Zhang JP (2011). Evaluation of etiological characteristics of Chinese women with recurrent spontaneous abortions: a single-centre study. Chinese Med. J. 124(9):1310-1315.

Munro SCB, Hall LR, Whybin L, Leader P, Robertson G, Maine T, Rawlinson WD (2005). Diagnosis of and screening for cytomegalovirus infection in pregnant women. J. Clin. Microbiol. 43:4713-4718.

Nahla KH, Ali YH, Enan KH (2011). Studies on congenital infections in Sudan: Seroprevalence of cytomegalovirus. J. Sci. Tech. 12(4):82-90.

Nigro G (2009). Maternal-fetal cytomegalovirus infection: from diagnosis to therapy. J. Matern. Fetal Neonatal Med. 22(2):169-174.

Picone OC, Vauloup F, Cordier AGI, Parent Du C, Senat MV, Frydman R, Grangeot-Keros L (2009). A 2-year study on cytomegalovirus infection during pregnancy in a French hospital. Br. J. Obstet. Gynecol. 116(6):818-823.

Saraswathy TS, Az-Ulhusna A, Asshikin RN, Suriani S, Zainah S (2011). Seroprevalence of cytomegalovirus infection in pregnant women and associated role in obstetric complications: a preliminary study. Southeast Asian J. Trop. Med. Public Health. 42(2):320-322.

Seo S, Cho Y, Park J (2009). Serologic screening of pregnant Korean women for primary human cytomegalovirus infection using IgG avidity test. Korean J. Lab. Med. 29(6):557-562.
Sotoodeh A, Mahin J, Mohammad RF, Abdolhosin M, Malihe A, Tasnim EE, Sima H (2010). Cytomegalovirus immunity in South of Iran. Am. J. Infect. Dis. 6:8-12.
Staras SAS, Dollard SC, Radford KW, Flanders WD, Pass RF, Cannon MJ (2006). Seroprevalence of cytomegalovirus infection in the United States, 1988-1994. Clin. Infect. Dis. 43(9):1143-1151.
Uyar Y, Balci A, Akcali A, Cabar C (2008). Prevalence of rubella and cytomegalovirus antibodies among pregnant women in northern Turkey. New Microbiol. J. 31(4):451-455.