

Seroprevalence of Cytomegalovirus among Pregnant Women in Hodeidah city, Yemen

Abstract

Introduction: Cytomegalovirus is an enveloped DNA virus from the Herpesviridae family. It is the most common cause of congenital infection. CMV is more widespread in developing countries and in communities with lower socioeconomic status.

Objective: The aim of the study was to determine the prevalence of CMV infection and identify risk factors of CMV seropositivity.

Methods: The study was a cross-sectional, descriptive, and experimental, combining the use of a structured questionnaire and analysis of serum samples obtained from 384 healthy pregnant women during the period from April 2014 to April 2015. The serum samples were analyzed for IgG and IgM antibodies to CMV by Electro-Chemiluminescence Immunoassay (ECLIA).

Results: Of the 384 healthy pregnant women, 379 (98.7%) and 7 (1.8%) were seropositive for Immunoglobulin G (IgG) and Immunoglobulin M (IgM) anti-CMV antibodies, respectively. Evaluation of age specific subgroups indicated high CMV IgG seropositivity rate for all age group. There was no statistical significant factor detected between CMV positivity rate with any socio-demographical and obstetrical characteristic (P-value <0.05).

Conclusion: The seroprevalence of CMV antibodies among pregnant women in Hodeidah city, western Yemen is high (98.7%), this finding is similar to other results reported from developing countries.

Keywords: Seroprevalence; Cytomegalovirus; Pregnant women; Hodeidah; Yemen

Research Article

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Abbreviations: CMV: Cytomegalovirus; ECLIA: Electro-Chemiluminescence Immunoassay; BOD: Bad Obstetric History

Introduction

Cytomegalovirus (CMV) is an enveloped DNA virus and a member of the family Herpesviridae and belongs to the subfamily beta herpesviridae. CMV has worldwide distribution, infects humans of all ages and all socioeconomic groups, and with no seasonal or epidemic patterns of transmission [1]. CMV infection during pregnancy is a major cause of congenital infection in developing countries with an incidence of 0.2-2.4% of live births [2].

The transmission of CMV in utero can occur following primary maternal infection during pregnancy but can also occur in women with natural immunity, either because of the reactivation of latent virus or by reinfection with a different strain [3]. Postnatal, CMV is also transmitted from mother to child through breastfeeding and close contact [4].

Risk of congenital infection is much higher during primary infection of the mother with transmission rate of 30%-40% compared with 0.15%-2.2% during reactivations and Reinfection

[5,6]. Seroprevalence studies among pregnant women worldwide have shown seropositivity rates for previous infection. A relatively low seroprevalence, 30%-60%, is reported from Australia, Belgium, France and Poland [7-10]. A high CMV seroprevalence (>90%) is reported from Turkey, Iran, India and Nigeria [11-14] and in Arab countries including, Saudi Arabia, Qatar, Palestine, Egypt, Sudan and Tunisia [15-20].

In Yemen, only a few studies have investigated the prevalence of CMV infection among women carried out in the Northern Governorates; Sana'a, and Ibb city, which found a seroprevalence of 100%, and 68% respectively [4, 14]. No information has been found in the literature on the epidemiology of CMV infection in the Southern, Eastern and Western regions of the country. Whether geographical differences between these regions and the Northern Governorates exist remains unknown. Therefore, we sought to determine the seroprevalence of CMV infection in pregnant women in Hodeidah city, Western Yemen. In addition, the socio-demographic and obstetrical characteristics of pregnant women associated with CMV infection were also investigated. The basic data concerned CMV infections during pregnancy is important for health planners and care provide.

Materials and Methods

Study area

Hodeidah Governorate is located on western a flat and narrow coastal plain between the foothills of the highlands and the Red Sea. It is the fourth largest Governorate in Yemen in the term of population which are (2157552), male: female ratio is 1:1, and children below 15 years are 50% of population, the total fertility rate in Hodeidah Governorate is 5.7. It is in a tropical zone, and the weather is typically hot and humid, summer months of April to November are very hot with temperatures sometimes exceeding 38 to 40° C, during the rest of the year temperature range between 27-35° C. Most of Hodeidah population is underline of poverty, almost 22% of people living in urban areas. It was estimated that 38% of adults were illiterate, 40% of households had no access to sanitary services.

Study disgen

This is a cross-sectional, descriptivewas conducted from April 2014 to April 2015, performed on healthy pregnant women (age range, 15 to 45 years) attending antenatal clinic in some hospitals and health centers in Hodeidah city, Yemen.

Data collection

A structured questionnaire was designed to collect information regarding socio-demographics and risk related data. Most the questions questionnaire was the yes/no questions which offer a dichotomous choice. The questionnaire was first developed in English and translated into Arabic language.

Sample collection

Five-ml blood sample was collected from 384 pregnant women by venipuncture, transferred into sterile anticoagulant-free sterile bottle, and allowed to clot. The clotted blood sample was centrifuged (3000 rpm, 5 min), and the serum (the supernatant) was transferred into cryovials and stored at -20° C until required for use.

Serologic testing

Samples of serum were tested for CMV-specific IgG and IgM antibodies using IgG and IgM Elecsys kit by Electro-Chemiluminescence Immunoassay technique (Cobas e411 analyzer, Roche Diagnostic GmbH, Mannheim, Germany). All the samples, reagents and calibrators were brought to room temperature an hour before the test according to the manufacturer's instruction.

Ethical approval

Approval for this study was obtained from the Ethical Review Committee in the Biology Department, Faculty of Sciences, Sana'a University.

Statistical analysis

Data were analysed using Epi info version 7.1.5 program (CDC Atlanta USA). Pearson chisquare test was used to determine associations between seroprevalence and the socio-demographic variables. Significance was set at 0.05 levels.

Results

Three hundred and eighty four pregnant women were investigated for seroprevalence of CMV infection.

Table 1 shows their sociodemographic characteristics. The mean (SD) of age, parity, gestational age (month) were 25.9 (5.6) years, 1.7 (2) and 5.5 (2.7) respectively. 263 (68.5%) of these women were born in Hodeidah Governorate and 121 (31.5%) were born in other Governorates. More than half of the pregnant women 273 (71.1%) were live in urban area. The illiterate women more than third 124 (32.3%) of the total population of this study. Most of the pregnant women 372 (96.9%) were unemployed (house wife).

Table 1: Socio-demographic variables of 384 pregnant women in Hodeidah city, Yemen.

Variable	Number (n)	Percentage (%)
Age		
15-25	212	55.2
26-35	155	40.4
36-45	17	4.4
Place of Birth		
Hodeidah	263	68.5
Other Governorates	121	31.5
Residence		
Rural	111	28.9
Urban	273	71.1
Education Level		
Illiterate	124	32.3
Basic	59	15.4
Primary	63	16.4
Secondary	108	28.1
University	30	7.8
Occupation		
House Wife	366	95.3
Farmer	6	1.6
Employee	12	3.1
Gestational Age (Trimester)		
First	114	29.7
Second	107	27.9
Third	163	42.4
Parity		
None	139	36.2
One to Four	208	54.2
>Four	37	9.6

Table 2, shows the relationship between seroprevalence of anti-CMV antibodies and some socio-demographic characteristics. Evaluation of age specific subgroups indicated high CMV IgG seropositivity rate for all age group but there was not statistically significant. A similar result was obtained for anti-CMV IgM seroprevalence (P>0.05). Even though, all women in the first trimester were 100% of CMV IgG seropositivity but there was not significantly associated with CMV seroprevalence for both IgG and IgM antibodies. In the same way, parity was not significantly associated with CMV seroprevalence for both IgG and IgM antibodies. Most of the subjects screened was Illiterate, there was no statistically significant difference between CMV seropositive and those with lower levels of education. Likewise, seroprevalence did not differ significantly between the different

occupational groups, place of birth and type of residential house owned by the subjects.

Table 3, shows the relationship between seroprevalence of anti-CMV antibodies and obstetrical characteristics. 16 (4.2%), 102 (26.6%), 47 (12.2%), and 5 (1.3%) of the pregnant women had a history of preterm delivery, spontaneous abortion, stillbirth, and malformed children, respectively. The seropositive of CMV IgG antibodies was 100% among all the obstetrical history. CMV IgM seropositivity mostly observed among women who had stillbirth history 2 (4.3%), least among those women who had spontaneous abortion history 2 (2 %), and absent in other obstetrical history. There was no significant association between any of the obstetrical history and seroprevalence of CMV (P-values > 0.05) tested by bivariate analysis.

Table 2: Distributions of CMV with socio-demographical characteristic of the pregnant women in Hodeidah city, Yemen.

Category	Participants		IgG Positive			IgM Positive		
	No.	%	No.	%	P- value	No.	%	P- value
Age								
15-25	212	55.2	207	97.6	0.13	6	2.8	0.3
26-35	155	40.4	155	100		1	0.6	
36-45	17	4.5	17	100		0	0	
Place of Birth								
Hodeidah	263	68.5	259	98.5	0.6	6	2.3	0.3
Other	121	31.5	120	99.2		1	0.8	
Residence								
Rural	111	28.9	109	98.2	0.6	0	0	0.09
Urban	273	71.1	270	98.9		7	2.6	
Education Level								
Illiterate	124	32.3	122	98.4	0.8	2	1.6	0.5
Basic	59	15.4	58	98.3		2	3.4	
Primary	63	16.4	63	100		0	0	
Secondary	108	28.1	106	98.2		3	2.8	
University	30	7.8	30	100		0	0	
Occupation								
House Wife	366	95.3	36	98.6	0.9	7	1.9	0.8
Farmer	6	1.6	6	100		0	0	
Employee	12	3.1	12	100		0	0	
Gestational Age (Trimester)								
First	114	29.7	114	100	0.2	0	0	0.1
Second	107	27.9	104	97.2		4	3.7	
Third	163	42.4	161	98.7		3	1.8	
Parity								
None	141	36.7	139	98.6	0.8	5	3.6	0.1
One to Four	209	54.4	206	98.6		2	1	
>Four	34	8.9	34	100		0	0	

Table 4, shows the seropositivity of pregnant women with history of blood transfusion was 100% but there was no statistically significant associated with anti-CMV IgG/IgM antibodies ($P>0.05$).

Table 3: Distributions of CMV with obstetrical characteristic of the pregnant women in Hodeidah city, Yemen.

Category	Participants		IgG Positive			IgM Positive		
	No.	%	No.	%	P- value	No.	%	P- value
Preterm Deliveries								
No	368	95.8	363	98.6	0.6	7	1.9	0.6
Yes	16	4.2	16	100		0	0	
Abortion (Miscarriage)								
No	282	73.4	277	98.2	0.2	5	1.8	0.9
Yes	102	26.6	102	100		2	2	
Stillbirths								
No	337	87.8	332	98.5	0.4	5	1.5	0.2
Yes	47	12.2	47	100		2	4.3	
Malformed Children								
No	379	98.7	374	98.7	0.8	7	1.9	0.8
Yes	5	1.3	5	100		0	0	

Table 4: Distributions of CMV with previous blood transfusions.

Blood Transfusions	Participants		IgG Positive			IgM Positive		
	No.	%	No.	%	P- value	No.	%	P- value
Yes	51	13.28	51	100	0.4	0	0	0.3
No	333	86.72	328	98.5		7	2.1	

Discussion

This is the first published data on the epidemiology of CMV infections among pregnant women in Hodeidah city, western Yemen. The present study was performed to investigate the seroprevalence and correlates of CMV infection in pregnant women in Hodeidah city, western Yemen. We found 98.7% seroprevalence of CMV IgG and 1.8% seroprevalence of IgM. These findings were similar to previous studies in Sana'a city Yemen (100%) [21]; Arab countries in Saudi Arabia (92.1%) [16], Qatar (96.5%) [15], Bahrain (100%) [22], Iraq (100%) [23], Palestine (99.6%) [20], Egypt (100%) [18], Sudan (97.5%) [19], and Tunisia (96.3%) [17]; and also Turkey (100%) [12], Iran (98.8%) [11], and the African countries Nigeria (94.8%) [14], Ethiopia (88.5%) [24], and Benin (100%) [25].

Lower seroprevalence in Yemen reported by Edrees, 2010 at a rate of 68% among pregnant women in Ibb city [26] and some regional studies Sudan (72.2%) among pregnant women [27] and Syria (74.5%) among college female students [8]. However the high lower seroprevalence reported in developed countries;

Japan (69.1%) [28], Mexico (65.6%) [29], Poland (62.4%) [10], Norway (59.9%) [29], Australia (57%) [7], England (49%) [30], France (43.7%) [9], Germany (43.3%) [15], and Belgium (30.2%) [8].

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 inclusion of CMV screening among the antenatal profile tests and better hygienic standards [31].

It is noteworthy in this study that age, parity, gestational age, occupation, educational level and place and type of residence were not associated with the risk of CMV positivity, because they did not reach significant levels.

In this present study, all women (100%) who had bad obstetric history (preterm delivery, spontaneous abortions, stillbirths, and malformed children) were of CMV IgG seropositivity. There was no statistically significant predisposing factor to CMV infection. However, one study carried out in Iraq found a significant association between CMV seropositivity and bad obstetric history

(BOH) [32]. A significantly higher seroprevalence of CMV IgG was reported in women with miscarriage history in Ibb city, Yemen [26], in Saudi Arabia [33] and in Sudan [19].

In the current study, the results showed that 100% seropositivity of pregnant women with history of blood transfusion were identified in this study. Data on CMV antibodies among our pregnant women prior to blood transfusion is not available to explain whether or not the 100% prevalence of CMV antibody among this group of subjects is due to blood transfusion. However, as the CMV antibody prevalence increases with age it is hard to conclude that the high prevalence among our pregnant women is due only to blood transfusion. High seropositivity rate has been extensively reported after transfusion-associated CMV [19,34]. Similarly, 96.6% anti-CMV IgG and 5.5% anti-CMV IgM seroprevalence was reported amongst apparently healthy blood donors in Sana'a city, Yemen [35-38]. Previous history of blood transfusion and socioeconomic status were, however, found in this study not to be significant factors to CMV antibody positivity. This might be related to the high seroprevalence of anti-CMV IgG in the Yemen population. Future studies in populations with similarly high seroprevalence may need higher recruitment numbers.

The main reason for the statistically non-significance in our correlation analyses is probably that the prevalence is quite high among women in our study, and it is therefore difficult to identify any factor associated with being seropositive (or seronegative).

Conclusion

The seroprevalence of CMV antibodies among pregnant women in Hodeidah city, western Yemen is high (98.7%), this finding is similar to other results reported from developing countries. This study concurs with previous studies that have suggested all women of the child bearing age to be incorporated in routine antenatal screening profile.

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