Sero-prevalence and risk factors for cytomegalovirus infection among pregnant women in a teaching hospital in Ogun state, Nigeria

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Abstract

Background: Infection with cytomegalo virus is usually asymptomatic however in pregnant women the risk of congenital infection and foetal abnormalities makes antenatal screening for CMV infection necessary. The aim of this study was to determine the sero-prevalence and risk factors for CMV infection among pregnant women in Babcock University Teaching Hospital (BUTH), Ilishan Remo, Ogun State, Nigeria.

Methods: The study was a cross-sectional descriptive study conducted between January and May, 2017 on patients attending the antenatal clinic of Babcock University Teaching Hospital. Enzyme Linked Immunosorbent Assay (ELISA) Kits were used to determine IgM and IgG anti CMV antibody titresin venous blood samples obtained from study participants.

Results: A total of 80 patients were recruited into the study. The mean age was 30 years.All (100%) respondents were sero-positive for anti CMV IgG antibodies while 28.75% of respondents were sero-positive for anti CMV IgM antibodies.

Conclusion: There was a highsero-prevalence rate of CMV infection in the study. Screening of pregnant women for CMV infection is necessary due to the risk of congenital infection and fetal defects.

Keywords: Cytomegalovirus, pregnant women, sero-prevalence, risk factors

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Séroprévalence et facteurs de risque d'infection à cytomégalovirus parmi les femmes enceintes dans un hôpital d'enseignement privé dans l'état d'Ogun, au Nigéria

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Resume

Contexte de l'étude : L'infection à cytomégalovirus est généralement asymptomatique, mais chez la femme enceinte, le risque d'infection congénitale et d'anomalies fœtales rend nécessaire le dépistage anténatal de l'infection à CMV. Le but de cette étude était de déterminer la séroprévalence et les facteurs de risque d'infection à CMV chez les femmes enceintes du Babcock University Teaching Hospital (BUTH).

Méthode de l'étude : L'étude était une étude descriptive transversale menée entre janvier et mai 2017 sur des patientes fréquentant la clinique prénatale du Babcock University Teaching Hospital. Des kits de dosage immuno-enzymatique (ELISA) ont été utilisés pour déterminer les titres d'anticorps IgM et IgG anti-CMV dans des échantillons de sang veineux prélevés sur les participants à l'étude.

Résultat de l'étude : Au total, 80 patients ont été recrutés dans l'étude. L'âge moyen était de 30 ans. Tous les répondants (100 %) étaient séropositifs pour les anticorps anti-CMV IgG tandis que 28,75 % des répondants étaient séropositifs pour les anticorps anti-CMV IgM

Conclusion : Le taux de séroprévalence de l'infection à CMV était élevé dans l'étude. Le dépistage de l'infection à CMV chez les femmes enceintes est nécessaire en raison du risque d'infection congénitale et de malformations fœtales.

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INTRODUCTION

Cytomegalovirus (CMV) is an enveloped, double stranded DNA virus (1).It can also be called Human herpes virus-5 (HHV-5) or Human cytomegalovirus (HCMV) (1). The global CMV sero-prevalence among women of reproductive age is around 86% (2). In developing nations, CMV is the second most common cause of congenital viral infections after Human Immunodeficiency Virus (3). Its mode of transmission is via contact with body fluids e.g saliva, tears, semen, breast milk, urine, faeces, blood (and blood products) and cervical secretions(1). Infection may persist for months to years after infection (4). Most cases of CMV infection are asymptomatic (5,6); however infections in immuno-compromised individuals may be associated with severe morbidity and mortality (7-9). In addition vertical transmission of infection through the placenta is possible and may be asymptomatic or may result in congenital defects e.g. microcephaly, hydrocephaly, sensori neural hearing loss and neurological deficits (10,11).

Pregnant women can transmit the virus to the fetus following a primary infection, a reactivation of a latent infection or a secondary infection (10,11). A non-primary infection shows a vertical transmission rate of 1-4% (12), while a primary infection has a vertical transmission rate of 30 -40% (8). Serological testing for CMV infection involves using Enzyme Linked Immunosorbent Assay (ELISA) to detect IgM and IgG antibodies. A positive IgM result infers an acute infection while a positive IgG result infers a recurrent or reactivated or previous infection.From the foregoing, it is important to identify CMV infection in pregnant women. The aim of this study, therefore was to determine the seroprevalence and risk factors for CMV infection among pregnant women in Babcock University Teaching Hospital (BUTH), Ilishan Remo, Ogun State, Nigeria.

MATERIALS AND METHODS
Study Area

The study was conducted in Babcock University Teaching Hospital (BUTH), a 240 bed tertiary institution located in Ilishan-Remo, Ogun State, South-Western Region, Nigeria.

Study Design

The study was a cross-sectional, descriptive study conducted between January and May, 2017at the antenatal clinic of BUTH. Study participants were pregnant women who were attending the antenatal clinic. Participants were consecutively recruited into the study until the sample size was achieved. Informed consent was obtained from all participants prior to inclusion in the study. Data was collected with the aid of a questionnaire. Enzyme Linked Immunosorbent Assay (ELISA) Kits were used to determine IgM and IgG anti CMV antibody titres in venous blood samples obtained from study participants. A positive IgM result inferred an acute infection while a positive IgG result inferred a recurrent or reactivated or previous infection. Strict infection prevention and control protocols were adhered to during sample collection, transport and processing.

Data Collection

Data was collected with the aid of a questionnaire. Data collected included socio-demographic information and obstetric history of study participants.

Sample Collection

Venous blood samples were obtained, from study participants, with the aid of vacutainers and placed in sterile (anticoagulant-free) bottles. Strict infection control and prevention protocols were strictly adhered to during sample collection.

Serological testing

Venous blood samples were allowed to clot and subsequently centrifuged (3000 rpm, 5 min). Serum obtained was transferred into cryovials and stored at -20°C until required for use. All samples, reagents and calibrators were allowed to reach room temperature about 15 minutes prior to testing. All samples of serum were tested for CMV-specific IgG and IgM antibodies using IgG and IgM ELISA kit Enzyme Linked Immunosorbent assay (ELISA) kits (Dia Pro Diagnostic BioprobesSrl. Sesto San Glovanni [MI] Italy) according to the manufacturer's specific instructions

Sample Size Determination

The sample size was determined by using the calculation below

Sample size (N) = Z^2pq/d^2 (13)

N= minimum sample size

Z = Confidence interval at 95% = 1.96

p=prevalence of pregnant women with a sero-positivity of CMV 94.8%(14)

d= Precision (margin of error 5%) =0.05

q=1-p

$N = (1.96)^2 \times 0.948 \times 0.052 / 0.05^2$

N= 67.35

A 10% increase in the minimum sample size was calculated to improve precision and reduce sample error due to non-response. A minimum sample size of 74 was therefore calculated for the study.

Inclusion and Exclusion Criteria: The study included pregnant women attending the antenatal clinic of BUTH and excluded women who were not pregnant and who were not patients of the antenatal clinic.

Ethical Consideration: Ethical clearance was obtained from the Babcock University Health Research and Ethics Committee (BURHEC Number: BUREHC 050/17). The study was explained to the patients and informed consent was obtained from study participants before data and sample collection.

Statistical Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS Inc. Chicago, IL). Nominal categorical variables included gender, ethnicity and occupation. Ordered categorical variables included educational level and income. Descriptive statistics showed the socio-demographic characteristics, obstetric history and sero-prevalence of cytomegalovirus infection of patients in the study.

RESULTS

The study involved 80 pregnant women attending the antenatal clinical of BUTH between January and May 2017. The mean age of the respondents was 30 years. The age range was 21 to 43 years. Table 1 shows the socio-demographic characteristics of the respondents.

The study showed that 43.75% of respondents had 2 previous pregnancies while 35% and 11.25% had 1 and 3 previous pregnancies respectively. In addition, 23.75% of respondents had a problem in their current pregnancy while 41.25% had complications in their previous pregnancies (Table 2).
All (100%) respondents were sero-positive for anti CMV IgG antibodies while 28.75% of respondents were sero-positive for anti CMV IgM antibodies (Table 3)

Table 4 shows that high rates of CMV infection were in respondents with a BA or BSc (56.52%), of Yoruba ethnicity (95.65%), Christian (78.26%) and who had no problems in their current pregnancy (69.57%)

DISCUSSION

This is the first study conducted to investigate the sero-prevalence of CMV infection among pregnant women in our institution. A total of 80 pregnant women responded in the study. The results revealed sero-prevalence rates of 100% and 28.75% for anti CMV IgG and IgM antibodies respectively. These results are similar to results obtained in previous studies. For example 93.3% (IgG) and 3.5% (IgM) in Nigeria(15);83% (IgG) and 9.46% (IgM) in India (16); 89.6% (IgG) and 0 % IgM in Mexico (17);99.4% (IgG) and 17.4% (IgM) in Pakistan (18); 96% (IgG) and 0 % (IgM) in Egypt (19); 96.6% (IgG) and 11.5% (IgM) in Palestine (20);70.7% (IgG) and 4% (IgM) in Finland (21); 93.3% (IgG) and 3% (IgM) in Bosnia and Herzegovina.(22). Lower rates were however found in other nations. For example 59.9% (IgG) and 1.3% (IgM) in Norway (23); 30.4% (IgG) in Ireland (24); 51.5% (IgG) in France (25); 23.47% (IgG) and 1% (IgM) in Canada (26); and 62.4% and 2.2% in Poland (27). The highest rates of infection (56.52%) in this study were among women with a BSc or BA degree. This is in contrast to a study done in Poland which showed higher rates of anti CMV IgG in women with primary and vocational education (72.9%) (27).

The study showed that 95.5% of infected women were of Yoruba ethnicity. This high rate may be explained by the fact that BUTH is situated in a predominantly Yoruba community.

Most patients infected with CMV (69.57%) had no complications in the index pregnancy. Infection with CMV is usually asymptomatic, however in pregnant women the risk of congenital infection and fetal anomalies makes it important to screen pregnant women for infection (5,6 10-12).

CONCLUSION

This study showed a high sero-prevalence rate of CMV infection (100%) in pregnant women. The risk of congenital infection and fetal defects makes it necessary to screen pregnant women for infection.

Conflict of Interest: None declared.

Funding: None

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Table 1: Socio- demographic Characteristics of Patients in the study

Demographic Characteristics	Frequency (N)	Percentage (%)
Ethnic Group		
Yoruba	73	91.25
Igbo	5	6.25
Hausa	0	0.00
Others	2	2.50
Marital status		
Married	75	93.75
Divorced	4	5.00
Single	1	1.25
Widowed	0	0.00
Religion		
Christianity	65	68.75
Islam	25	31.25
Others	0	0.00
Education		
No formal education	6	7.50
Primary school	6	7.50
Secondary school	19	23.75
A-level or pre-degree	10	12.5
BA, BSc	37	46.25
MBBS, PHD	2	2. 50
Housing		
Nature of respondents home		
It is owned by you		
It is rented by you		
It is occupied with without payment		
Lives with friends		
I live with family		
I have no permanent residence		
Job		
Do you work for pay outside the home		
Yes	56	
No	24	
Work situation		
Working full time	62	77.50
Working part time	13	16.25
Not working and not looking for job	6	7.50
Unemployed and looking for job	17	21.25
Disabled or retired and not looking for job	21	26.25
Currently in school	0	0
Income		
What is your total combined family income per month before tax, from all sources wages, public assistance, help from relatives, alimony and so on.		
Less than N30,000	23	28.75
N30,000- N50,000	13	16.25
N51,000- N100,000	6	7.50
Above N100,000	17	21.25
Chose not to answer	21	26.25

Table 2: Obstetric History of Patients in the study

Obstetric History of Respondents	Frequency (N)	Percentage (%)
Number of previous pregnancies?		
1	28	35.00
2	35	43.75
3	9	11.25
4	8	10.00
>4	0	0.00
Expected date of Delivery?		
Definite date	48.00	60.00
Unknown date	32.00	40.00
Problems with current pregnancy?		
Yes	19	23.75
No	61	76.25
Previous genetic test done during pregnancy?		
Yes	42	52.50
No	42	52.50
Complications in previous pregnancies?		
Yes	33	41.25
No	47	48.75
In your previous pregnancies, did your child have any of the following?		
Low birth weight	14	17.50
Microcephaly	11	13.75
Seizures	2	2.50
Jaundice	5	6.25
None	48	60.00

Table 3: Sero-prevalence of Cytomegalovirus among Pregnant Women in BUTH based on ELISA Analysis of Cytomegalovirus IgM antibodies and IgG antibodies

	IgM Frequency (Percentage %)	IgG Frequency (Percentage %)
Positive	23 (28.75%)	80 (100%)
Negative	57 (71.25%)	0 (0%)

Table 4: Cross Tabulation of Cytomegalovirus on Educational background, ethnicity, marital status, Occupation, and Religion.

Percentage of Respondents With Cytomegalovirus Infection

Educational background	Presently infected with CMV (%)	Not infected (%)
No formal education (N =6)	4.35	8.77
Primary school (N=6)	8.70	7.02
Secondary school (N= 19)	17.39	26.32
A-level or pre-degree(N =10)	8.70	14.04
BA or BSc (N =37)	56.52	42.11
Masters, PHD (N =2)	4.35	1.75
Ethnic group		
Yoruba (N =73)	95.65	89.47
Igbo (N = 5)	4.35	7.02
Hausa (N =0)	0.00	0.00
Others (N = 2)	0.00	3.51
Religion		
Christians (N = 65)	78.26	64.91
Islam (N = 25)	21.75	35.09
Others (N=0)	0.00	0.00
Problems in Current Pregnancy		
Yes (N =19)	30.43	21.05
No (N =61)	69.57	78.95