Seroprevalence of Cytomegalovirus Antibodies in Pregnant Women, Benue State, Nigeria

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Received date: September 7, 2015; Accepted date: October 2, 2015; Published date: October 10, 2015

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Abstract

Cytomegalovirus (CMV), a member of the herpes family, belongs to a group of vertically transmitted infections referred to as the TORCH complex including: Toxoplasmosis, Rubella, Cytomegalovirus and Herpes Simplex. Known to be frequently transmitted to developing foetus, it remains one of the leading causes of congenital viral infections. Although the infection has been detected in Nigerian neonates, its awareness is limited particularly in a growing metropolitan city like Makurdi, Nigeria. In this study, the prevalence of CMV antibodies and their association with some socio-demographic factors in pregnant women was evaluated. Pregnant women (N=375; age range=15 to 50 years) attending ante-natal clinic in different hospitals in Makurdi were screened for the infection. Five-ml venous blood was collected from each participant for serological studies, and structured questionnaire was used to obtain socio-demographic data. Serum samples were assayed using enzyme-linked immunosorbent assay (ELISA) technique. The overall prevalence of anti-CMV IgG-antibodies was 93.3% (n=350) and was 3.5% (n=13) for anti-CMV IgM-antibodies. Prevalence of anti-CMV IgG and IgM antibodies was significantly associated with gravidity (P<0.012; P<0.001), while prevalence of anti-CMV IgM only was associated with marital status (P=0.035). The prevalence of anti-CMV IgG antibodies was highest (100%) in older pregnant women aged 41-50 years, but was lowest (85.0%) in younger ones aged 15-20 years. Risk factors for the disease such as history of blood transfusion, scarification, and multiple sexual partners were important, even though not statistically significant (P>0.05). Women of child-bearing age in the growing metropolitan city of Makurdi, Nigeria need to be educated on precautionary measures that will prevent cytomegalovirus infection.

Keywords: Cytomegalovirus; CMV IgG Antibodies; CMV IgM Antibodies; Benue state; Nigeria

Introduction

Human CMV is an enveloped DNA virus and a member of the herpes family that belongs to a group of vertically transmitted infections known as TORCH – Toxoplasmosis, Rubella, Cytomegalovirus, and Herpes simplex. The virus is ubiquitous and the infection it causes is generally asymptomatic. It is a leading cause of disability in children and a common cause of congenital viral infection that results in avoidable conditions such as mental retardation, neurological impairment, and permanent hearing and vision loss. As it is the commonest viral infection in pregnancy, it can have serious consequences in pregnant women and in immunocompromised patients, and may even pose a teratogenic danger during pregnancy [1].

CMV infection occurs in many parts of the world irrespective of geographical location and socio-economic group [2,3]. The prevalence of the infection appears to be higher in developing nations than in the developed ones [4] and Africa seems to have the highest prevalence. Nonetheless, high seroprevalence has been reported in some developed nations of the world [5,6]. CMV is frequently transmitted to the developing fetus during pregnancy. Sexual activity and contact with the urine or saliva of young children [7] are other means of transmitting the infection. Infection is lowest at the time of conception but highest during the third trimester of pregnancy [8]. The risk of intrauterine infection depends on the period of maternal infection during pregnancy. Rate of CMV infection transmission to fetus during pregnancy is higher if the infection is primary than if it were secondary. For primary infection the estimated rate of transmission was between 25% and 75%, but was between 0.2% and 2.0% for secondary infection [9]. Congenital infection in the fetus usually occurs if the mother has a primary infection or a recurrent infection during pregnancy. Maternal infection during the first trimester seems to be associated with adverse effect in the fetus [10]. In Nigeria, previous studies on the seroprevalence of CMV infection in Nigeria had focused on some major cities of the country giving little or no information on the middle-belt region of the country. Given the general unawareness of the infection in pregnancy and the serious consequences it poses to the unborn child, this study was undertaken to assess the seroprevalence of this infection in the middle-belt region of Nigeria, and to determine its associated risk factors.

Materials and Methods

Study area

Makurdi is the capital of Benue State, in the middle-belt of Nigeria. It is located on latitude 7°43’32” N and longitude 8°33’51” E, and has a population between 250,000 and 500,000. Temperature ranges between 23°C and 35°C depending on the time of the year. Farming is the main occupation of the inhabitants; other professions include civil service, business, and petty trading.

Keywords:
Cytomegalovirus; CMV IgG Antibodies; CMV IgM Antibodies; Benue state; Nigeria
Hospital, Makurdi (primary health-care facility).

Informed consent was obtained from all participants (age range, 15 to 50 years) attending ante-natal clinic at the Federal Medical Centre, Makurdi (a referral health-care facility) and Madonna Centre, Makurdi (a referral health-care facility) and Madonna Hospital, Makurdi (primary health-care facility).

Ethical consideration

Ethical approval was obtained from the Research Ethics Committee of Federal Medical Centre Makurdi. Permission for the study was sought from Head of Medical Microbiology Laboratory. Written informed consent was obtained from all participants after detailed explanation of nature and objectives of the study was given to them in English and local languages.

Study population

Cross-sectional data were collected from 375 pregnant women (age range, 15 to 50 years) attending ante-natal clinic at the Federal Medical Centre, Makurdi (a referral health-care facility) and Madonna Hospital, Makurdi (primary health-care facility).

Sampling technique

Consecutive sampling technique was employed in this study.

Exclusion criterion: Non-consenting pregnant women.

Inclusion criterion: Consenting pregnant women aged 15-50 years.

Table 1: Seroprevalence of anti-CMV IgG and IgM antibodies in pregnant women.

| CMV IgG | CMV IgM | Total |
|---------|---------|-------|
|         | positive | negative | Number (%) | Number (%) | Number (%) |
| positive | 13 | -3.5 | 337 | -89.9 | 350 | -93.3 |
| negative | 0 | 0 | 25 | -6.7 | 25 | -6.7 |
| Total | 13 | 0.035 | 362 | -96.5 | 375 | -100 |

Note: four infection categories were observed: Primary infection cases=IgG+/IgM- Previously exposed cases=IgG-/IgM- Recent primary infection cases=IgG+/IgM+ Susceptible persons=IgG-/IgM-

Table 2: Seroprevalence of CMV by age, parity and gestational age.

| Category | entire group | IgG | IgM |
|----------|--------------|-----|-----|
|          | Number | seropositive | (%) | Number | seropositive | (%) |
| Age      |         |            |     |         |            |     |
| 15 - 20 yr. | 20 (100) | 17 | -85 | 1 | -5 |
| 21 - 30 yr. | 266 (100) | 247 | -92.9 | 10 | -3.8 |
| 31 - 40 yr. | 81 (100) | 78 | -96.3 | 2 | -2.5 |
| 41 - 50 yr. | 8 (100) | 8 | -100 | 0 | 0 |
| TOTAL    | 375 (100) | 350 | -93.3 | 13 | -3.5 |

Chi-square value = 4.043 (P=.257), 0.737 (P=.865)

Table 2: CMV seroprevalence by age, parity and gestational age.

| Gestational age | No. of pregnancies |
|-----------------|--------------------|
| 1st trimester   | 44 (100) 39 | -88.6 | 1 | -2.3 |
| 2nd trimest    | 188 (100) 176 | -93.6 | 7 | -3.7 |
| 3rd trimest    | 143 (100) 135 | -94.4 | 5 | -3.5 |
| TOTAL          | 375 (100) 350 | -93.3 | 13 | -3.5 |

Chi-square value = 1.849 (P=.397), 0.225 (P=.894)

Statistical analysis

Data were analysed using SPSS version 19 (2010). Pearson chi-square test was used to determine associations between seroprevalence and the socio-demographic variables. Significance was set at 0.05 level.

Results

The seroprevalence of CMV specific IgG and IgM antibodies for the 375 women enrolled in this study were 93.3% (350/375) for IgG seropositivity (IgG+) and 3.5% (13/375) for IgM (IgM+) seropositivity. As shown in Table 1, 3.5% of the pregnant women who were IgG+/IgM+ were classified as having primary CMV infection, 89% who were IgG+/IgM- as having had previous exposure of the infection, and 6.7% who were IgG-/IgM+ were classified as susceptible. None of the study population was IgG+/IgM- indicating that none of them (0%) had recent primary infection.

Citation: Umeh EU, Onoja TO, Aguoru CU, Umeh JC (2015) Seroprevalence of Cytomegalovirus Antibodies in Pregnant Women, Benue State, Nigeria. J Infect Dis Ther 3: 242. doi:10.4172/2332-0877.1000242
IgM seroprevalence (P>0.05). CMV seroprevalence (for both IgG and IgM antibodies) was higher in multiparous pregnant women than in those who had never been pregnant.

As shown in Table 2, seroprevalence increased from 85.0% in the youngest age group to 100.0% in the oldest age group for IgG, but these differences in seroprevalence according to age group were not statistically significant. A similar result was obtained for anti-CMV IgG seroprevalence (P=0.05). CMV seroprevalence (for both IgG and IgM antibodies) was higher in multiparous pregnant women than in those who had never been pregnant.

Nonetheless, seroprevalence increased with increase in number of earlier pregnancies. In the same way, gestational age was not significantly associated with CMV seroprevalence for both IgG and IgM antibodies, even though prevalence was least in those who were in earlier pregnancies. In the same way, gestational age was not significantly associated with marital status (Table 3). On the contrary, the occurrence of anti-CMV IgM antibodies was significantly associated with marital status. Neither history of miscarriage nor the number of times miscarriage occurred showed any relationship with seroprevalence of anti-CMV antibodies.

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Table 3: CMV seroprevalence by marital status, history of miscarriage and number of times miscarried.

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Table 4: CMV seroprevalence by some socio-demographic factors.

Table 5: CMV seroprevalence by some bloodletting risk factors (or practices) investigated was significantly associated with anti-CMV IgG/IgM antibodies.
As portrayed in this study, age was not significantly associated with CMV infection, but the increase in seroprevalence with age could be attributed to weakening of the immune system with increase in age as suggested by Redwan et al. [2].

Although not statistically significant, occupation, parity, place and type of residence appeared to have shown group variations in seroprevalence. In addition, such factors as miscarriage, tattoo, scarification, blood transfusion intravenous drug use and increase in number of partners seemed to be predisposing the women to CMV infection: infection seroprevalence was highest in those who indulged in bloodletting practices and in those who had history of blood transfusion [15-19].

Out of 375 women, 25 have never been exposed to CMV, indicating that these women are susceptible to CMV infection, and are at risk of coming in contact with the virus for the first time during pregnancy (primary infection). The likelihood of giving birth to congenitally infected infants is therefore high. Preventive measures which include strict hygienic practice should be adhered to in order to avoid primary infection during pregnancy [20-23]. The high seroprevalence may be the result of ignorance about the infection, poor hygiene, inadequate health care facilities and low socio-economic level [24].

In Makurdi, few people are aware of CMV disease, and as a result of this, little or no control measures are put in place by either governmental agencies or non-government organizations to curb the infection [25,26]. In more developed parts of the world, several intervention measures that would reduce the incidence of CMV infections are being executed. We recommend that such intervention measures (e.g., minimising close contact with possible sources of infection, maintaining good hygiene especially during pregnancy, use of prophylactic drugs in susceptible individuals, use of anti-viral drugs in treatment of acute cases of the infection) be adopted in areas where the prevalence of the infection is high as in Makurdi, Benue State. Awareness on the dangerous consequences of CMV to the newborn baby should be created [27].

Table 5: CMV seroprevalence by some risk factors.

| Risk Factor                | No | Yes | Chi-square | Significance |
|----------------------------|-----|-----|------------|--------------|
| Intravenous Drug Use       |     |     |            |              |
| Yes                        | 13  | 11  | 0.962      | P=0.402      |
| No                         | 362 | 337 | 0.523      | P=0.405      |
| Tattoo                     |     |     |            |              |
| Yes                        | 28  | 40  | 1.322      | P=0.415      |
| No                         | 322 | 310 | 1.297      | P=0.345      |
| Scarification              |     |     |            |              |
| Yes                        | 40  | 28  | 1.129      | P=0.345      |
| No                         | 310 | 30  | 0.523      | P=0.405      |

*No statistics are computed because CMV IgG is a constant
**No statistics are computed because Sharing Needles is a constant

Table 5: CMV seroprevalence by some risk factors.

Discussion

The results of this study have shown that most of the pregnant women screened have been infected with CMV, while only few had primary CMV infection. This result is consistent with reports from other parts of the world including Nigeria [2,3] in which a high seroprevalence of anti-CMV IgG antibodies and low anti-CMV IgM antibodies (indicating recent CMV infection) in pregnant women was reported and reported low anti-CMV antibodies as in this study [11]. On the other hand, results of studies from developed parts of the world reported low prevalence of anti-CMV IgG antibodies in pregnant women [12-14]. However, higher seroprevalence of anti-CMV IgG antibodies have been reported in Germany [5] and northern Italy) [6]. Primary CMV infection is critical because primary CMV infection is a significant risk factor for vertical transmission of CMV infection to newborn babies with its entire associated clinical conditions.

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