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Seroprevalence of Cytomegalovirus (CMV) Amongst Voluntary Blood Donors in University of Benin Teaching Hospital (UBTH), Edo State, Nigeria

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Case Study

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ABSTRACT

Aim: To investigate the seroprevalence of cytomegalovirus (CMV) among voluntary blood donors in University of Benin Teaching Hospital (UBTH), Nigeria with the purpose of determining whether routine CMV screening for donors is justified or not.
Place and Duration of Study: Department of Haematology and Department of Medical Microbiology, University of Benin Teaching Hospital (UBTH), Benin city, Nigeria, between May and September, 2010.
Methodology: Sera from randomly selected one hundred and ninety-two (192) voluntary blood donors, consisting of 176 males and 16 females that visited the hospital from May to September 2010 were evaluated for CMV-IgG and IgM antibodies using an enzyme-linked immunosorbent assay (ELISA) based kit.
Results: Seroprevalence for CMV-IgG and IgM were 95.8% and 3.1% respectively. All female donors (n=16) were positive for IgG. A total of 114 out of 192 (59.4%) donors were within the age bracket of 30-39 years. A prevalence of 100% for CMV IgG antibody was observed in age group ≥50 years,
Conclusion: Routine screening of donors for CMV-IgG antibody would amount to waste of resources given the high prevalence of 95.8%. Periodic screening to identify the small percentage of seronegative blood donors (4.2%) who are needed for the ever increasing number of immunosuppressed recipients is recommended.

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1. INTRODUCTION

Cytomegalovirus (CMV) is a large encapsulated double stranded DNA virus belonging to the beta-herpesvirus group. Over the years, it has come to assume an important public health problem as it may cause serious morbidity and mortality in congenitally infected newborns and immunocompromised patients, most notably transplant recipients and HIV-infected persons (Charkravarti *et al*., 2009). It is one of the viruses that can be transmitted through blood transfusion. It is however not routinely screened for in blood donors in Nigeria. Other viruses that can be transmitted through blood transfusion are Hepatitis B and C; and human retroviruses such as human immunodeficiency virus (HIV) and human T-lymphotropic viruses types 1 and 2 (Kuhn, 2000). The risk of transmitting these viruses has drastically been reduced by screening for their antibodies before transfusion (Herve, 2000).

It has been reported that most adults across the globe are seropositive for CMV (Hecker *et al*., 2004). Depending on the socioeconomic status, seropositivity for adult population over forty years ranges from 60 to 100% possibly as a result of transmission through intrauterine (or at parturition), breastfeeding, blood transfusion, sexual contact and spread from children (Hecker *et al*., 2004; Adjei *et al*., 2006). It tends to be lower in the developed countries than the developing countries (Adjei *et al*., 2006).

Transfusion transmitted-cytomegalovirus (TT-CMV) is a significant cause of morbidity and mortality in the immunocompromised host. The risk of TT-CMV from seropositve donors is reported to be 0.4 to 12% (Krajden *et al*., 1996). In developed countries such as the US, implementation of stringent donor eligibility criteria and more sensitive methods of viral genome detection have virtually eliminated TT-CMV infection; however in developing countries like India and Nigeria, the risk is as yet considerable(Charkravarti *et al*.,2009; Alao *et al*., 2008). A study of the seroprevalence of CMV in this part of the world is therefore justified as it would enable us determine whether or not blood donors should be routinely screened for the virus, if not for transfusing the general population, at least for immunocompromized individuals.

2. MATERIALS AND METHODS

2.1 Patients (Blood Donors)

The study population constituted 192 healthy voluntary blood donors randomly selected from donors presenting at the blood bank of University of Benin Teaching Hospital from May to September, 2010.Of these patients,176 (91.7 %) were males and 16 (8.3 %) females, mean age was 32.39 ± 7.9 years with a range of 18-53 years.

2.2 Blood Samples

A 5-ml blood sample was collected from each donor after obtaining informed consent. The sera were separated and stored at -20ºC. Each donor was also asked to complete a questionnaire to provide information regarding age, sex, occupation, ethnic group, marital status and past history of transfusion.

The sera were later analyzed for CMV-specific IgG and IgM (Clinotech CMV IgG and IgM ELISA test kits, Canada), according to the manufacturer's instruction. Optical density (OD) ratio for each specimen was calculated by dividing its OD value at 450nm wavelength with the calibrator OD. Optical ratio ≤ 0.9 is negative, ≥ 1.0 positive, and 0.91-0.99 equivocal. The controls and the calibrators of both the IgG and IgM test kits, all passed the validation check set by the manufacturer. Ethical approval was obtained from the Ethical Committee of the University of Benin Teaching Hospital.

2.3 Statistics

The data obtained were subjected to descriptive statistical analysis using SPSS version 16. Chi square was used to determine associations. Significant association is presumed if $p<0.05$.

3. RESULTS AND DISCUSSION

A total of 192 voluntary blood donors took part in the study, comprising 176 (91.7%) males and 16 (8.3%) females. The mean age was 32.39 ±7.9 years with a range of 18-53 years. Seropositivity for CMV-IgG antibodies was found in 184(95.8%) while 8 (4.2%) were seronegative, giving a prevalence rate of 95.8% (Table 1). Also, 6(3.1%) donors were positive for CMV IgM antibody.

Table 1: Seroprevalence of CMV IgG and IgM antibodies among donors in Benin

Status	Anti-CMV IgG	%	Anti-CMV IgM	%
Positive	184	95.8	6	3.1
Negative	8	4.2	186	96.9
Total	192	100.0	192	100.0

Table 2 shows the seroprevalence of CMV IgG antibody with respect to age groups. Majority of the donors (114 out of 192) were within the age bracket of 30-39 years. The highest prevalence (100%) was observed in the age group ≥50 years and the lowest prevalence (88.2%) in 20-29years age bracket. There was no statistically significant difference in the CMV IgG status in the different age brackets ($P>0.05$).

Table 2: Age and sex distribution of CMV-IgG antibody seropositive donors

Age group in years	Number of subjects	Male n=176 (pos. cases)	Female n=16 (pos. cases)	Total pos. cases n=184 (% pos. cases)
<20	17	12 (11)	5 (5)	16 (94.1)
20-29	31	25 (23)	6 (6)	29 (93.5)
30-39	114	110 (106)	4 (4)	110 (96.0)
40-49	25	24 (23)	1 (1)	24 (96.0)
≥50	5	5 (5)	0 (0)	5 (100.0)
Total	192	176 (168)	16 (16)	184 (95.8)

Out of 192 blood donors screened, 14 (7.3%) had a past history of blood transfusion, and were all positive (100%) for CMV IgG antibody. Of the 178 (92.3%) who had no history of

blood transfusion, 169(94.9%) were positive for CMV IgG antibody (Table 3). There is however, no significant statistical association existing between voluntary blood donors with positive history of previous blood transfusion and seropositivity for CMV IgG antibody, (P>0.05).

Table 3: Relationship between previous history of transfusion and CMV antibody seropositivity

Blood Trans History	Number tested	IgG Positive (%)	IgM Positive(%)
Yes	14	14 (100.0%)	2 (14.3%)
No	178	169 (94.9%)	4 (2.2%)
Total	192	183 (95.3%)	6 (3.1%)

The seroprevalence of 95.8% for CMV IgG antibody among voluntary blood donors in this study is high. This suggests that quite a number of people in the study area have been previously exposed to CMV. This result is comparable to prevalence rates of 92% and 96% obtained in separate studies previously carried out in Nigeria (Alao *et al*., 2008; Akinbami *et al*., 2009). Other studies in Ghana and India showed prevalence rates of 93.2% and 95%, respectively (Adjei *et al*., 2006; Krajden *et al.*, 1996). The high prevalence rates observed in these countries contradict those of western nations which ranged from 38% to 75% (Krech, 1973). The possible explanation for this contrast may have to do with different prevailing socio- economic, environmental and climatic factors (De-Jong *et al.*, 1998). It is however interesting to note that a rate as high as 90% has been recorded in Japan and Hongkong; countries that are not regarded as developing nations (Kothari *et al.*, 2002).

Seroprevalence for CMV IgM antibody was found to be 3.1% representing the percentage of those that had active infection. Previous studies have reported rates of 0% and 19.5% in Ghana and Nigeria, respectively (Adjei *et al.*, 2006; Akinbami *et al*., 2009). Varying methodologies perhaps may have contributed to the disparities observed. Active infection could result from reactivation of latent CMV infection or fresh exposure to CMV. IgG avidity index could be done where facilities exist to differentiate the two (Bodus and Goubau, 1999).

In this study majority of the donors were males (176 males against 16 females), thus there was insufficient power for statistical comparisons. It has, however, been reported that there was no correlation between sex and seropositivity of CMV (Kothari *et al*., 2002). Prevalence rate of CMV IgG antibody in the present study did not vary in any particular direction with the different age groups. This is contrary to a previous report from North-East Scotland that showed significantly higher seropositivity with increasing age (Galea and Urbaniak, 1993).

The present study has also revealed that there is no statistical relationship between previous history of blood transfusion and seropositivity for both CMV IgG and IgM antibodies among blood donors (P>0.05), implying that previous blood transfusion is not a risk factor for CMV infection. This same conclusion has been arrived at by other researchers (Akinbami *et al.,* 2009; Beneke *et al.*, 1984). Possible explanations are that there are various other routes through which CMV is transmitted in Nigeria including intrauterine (or at parturition), breastfeeding, sexual contact and spread from children. Some studies, however, suggest there is a relationship between transfusion and CMV antibody seropositivity (Tolpin *et al.*, 1985; Zang *et al.*, 1995). One such study reported that CMV can be transmitted through transfusion, with a frequency of about 0.14% to 10% per unit of blood (Zang *et al*., 1995).

Since the majorities (95.8%) of blood donor in this environment were seropositive for CMV IgG, it would amount to a waste of time and resources to routinely screen donors for CMV IgG. However, bearing in mind that the risk of TT-CMV is especially high among immunosuppressed recipients, there is a need to identify the few 4.2% of blood donors that are seronegative and keep an inventory of them so they can be easily contacted when they are needed. In the US, cases of TT-CMV in immunosuppressed recipients have been brought to the barest minimum by insisting on CMV seronegative blood or deglycerolized frozen red blood cells (Holland and Schmitt, 1987).

In low resource settings like Nigeria, we recommend periodic screening to identify the few seronegative donors in the population and keep a medical history of them so as to call upon them when needing blood transfusions for immunosuppressed recipients.

One limitation of this study is that majority of the donors were males and fell into 30-39years age bracket; therefore the results may not be generalizable to other populations in Nigeria.

4. CONCLUSION

Seroprevalence of CMV IgG among voluntary blood donors in Benin (95.8%) is high. Routine screening of blood donors for CMV is therefore not justified. Periodic screening to identify seronegative donors who might be called upon when needing blood transfusion for immunosuppressed recipients, is recommended.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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