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Cytomegalovirus Co-infection among Human Immunodeficiency Virus (HIV) Positive Patients in Bida, Niger State, Nigeria.

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Abstract

In immunocompromised individuals, Cytomegalovirus (CMV) primary infection, reactivation and reinfection cause severe disease with a high case of fatality unless diagnosed and treated appropriately at an early stage. A synergistic effect may worsen the immunological profile and could potentially translate into a more rapid disease progression in HIV infection. This study was conducted to determine the prevalence of cytomegalovirus co-infection, evaluate the immunological outcome and risk factors of primary CMV infection among HIV positive patients in Federal Medical Centre Bida. Blood samples were collected for CMV IgG and IgM ELISA testing of three hundred and eighty-five (385) HIV positive patients on HAART. CD4⁺ cell counts were estimated using a new model Partec Cyflow counter. Out of the three hundred and eighty-five (385) HIV positive subjects, an overall distribution of 84.2% IgG and 19.8% IgM CMV were found among patients with HIV in Bida. CD4⁺ count <200 cells/ μ l was a risk factor for acquiring primary CMV infection however, patients with moderate and high CD4⁺ count (>200 to 1000 cells/ μ l) were susceptible and had high chances of developing reactivation of CMV infection in HIV/AIDS. There was no significant difference between CMV primary infection and CD4⁺ count ($p > 0.05$). Previous history of blood transfusion was a risk factor for CMV infection among HIV patients in Bida.

Keywords: CMV, HIV, CD4⁺, Blood Transfusion, Bida.

Introduction

Cytomegalovirus (CMV) is an enveloped double-stranded DNA virus, a potential killer or lifelong silent companion (Leguizamón *et al.*, 2004). Cytomegalovirus is a worldwide infection and it is the most common congenital virus in the world which are transmitted naturally by direct or indirect contact. Humans are the only reservoir for these viruses (Neto *et al.*, 2004). Human cytomegalovirus infection is endemic and occurs throughout the year, it has no seasonal pattern. About 40-80% of individuals are seropositive at puberty though an early childhood infection (Gold and Nankervis, 1989). CMV a member of the human Herpes family of viruses, transmissible through blood component, transfusion is an important cause for concern worldwide this is because the majority of adults have serological evidence of previous infection. (Zhang *et al.*, 1995). The prevalence of seropositivity of CMV in the adult population over 40 years of age worldwide are reported to be 60-100%, due to transmission through sexual contact, spread from children and breastfeeding (Helker *et al.*, 2004).

Like most other Herpesviruses, CMV is latent in their host after primary infection and persists for life (Drobyskin *et al.*, 1993). Nevertheless, reactivation

in immunosuppressive individuals leads to end organ disease such as retinitis, encephalitis and interstitial pneumonitis (Manez *et al.*, 1993). CMV is considered to be one of the most serious pathogens affecting immunosuppressed individuals (Wen *et al.*, 1996). Primary CMV is followed by a persistent infection and under certain circumstances recurrence occurs, after primary infection. Specific antibody titre persist for life, spread through susceptible population is enhanced by the prolong excretion of virus that continues for years after congenitally, neonatal and postnatal acquired (Gold and Nankervis, 1989). In people with a functional immune system, the initial infection with CMV may cause a mild flu like illness and later the virus may remain dormant, while damaged immune system supports the reactivation of CMV. A synergistic effect may worsen the immunological profile and could potentially translate into a more rapid disease progression in HIV infection (Chakravarti *et al.*, 2009). CMV IgG antibodies are detectable in long standing CMV seropositive individual though, the clinical manifestation of the disease does not present until $CD4^+$ count drops below $100\text{cells}/\text{mm}^3$ (Palestine *et al.*, 1991). CMV co- infection is a major cause of morbidity and mortality in individuals with depressed cell mediated immunity associated with Acquired Immunodeficiency Syndrome AIDS (Macher *et al.*, 1983). HIV/AIDS individuals are at serious risk of developing CMV end organ disease (Jacobson and Mills, 1988).

Clinical manifestation occurred in 25-40% of AIDS patients before the starts of Highly Active Antiretroviral Therapy (HAART) (Kempen *et al.*, 2003) all reported that the incidence of CMV disease declined rapidly and significantly by use of HAART. In these patients, end organ disease frequently occurred as a reactivation of latent virus in CMV positive patients. However, $CD4^+$ levels less than $50\text{ cells}/\text{mm}^3$ are good indicators in the prognosis of clinical manifestation of CMV (Spinger and Weinberg, 2004).

In advanced AIDS, CMV end-organ disease are in the increase due to co-infection with CMV. However, some studies before the era of HAART reported a higher rate of CMV end- organ disease

among patients with advance HIV infection of about 40% or greater, but with the advent of HAART there is a tremendous reduction (Wohi *et al.*, 2009 and Stewart, 2010).

The aim of this work was to study the seroepidemiology of Cytomegalovirus infection in Human Immunodeficiency Virus Co-infected individuals and risk of acquiring primary CMV infection in patients attending Anti-Retroviral Therapy Clinic in FMC Bida Niger State.

Materials and Methods

Scope of Study

This study was a cross sectional and epidemiological study of patients with HIV infection attending the Anti-Retroviral Therapy (ART) Clinic of Federal Medical Centre Bida, Niger State.

Study Area

The study was carried out in the Anti-Retroviral Therapy (ART) Clinic of Federal Medical Centre, Bida, located in Bida Local Government Area of Niger State, North Central Nigeria. Bida is the second largest town in Niger State. Bida Local Government Area covers an area of 51 square kilometers and has a population of 188,181. Bida is located South-West of Minna the capital of Niger State, about nine km North of River Kaduna, along Bida-Mokwa road. It is a dry and arid town and the major ethnic group is Nupe. Bida is the headquarters of the Nupe kingdom and the title by which their Emir is called is 'Etsu Nupe'. The town is known for its production of traditional crafts notably glass and brass ware. Bida is also known for its Durbar festival (Federal Republic of Nigeria Official Gazette, 2007).

Bida Local Government is made up of fourteen political wards. Federal government institutions sited in the town are; The Federal Polytechnic, National Cereals Research Institute, Federal Government Girls College and Federal Medical Centre Bida. There are about nine government health institutions which include, a Federal Medical Centre (FMC), a general hospital, five primary health care clinics and two dispensaries. There are also over ten private



health institutions. There are other social amenities in the town like pipe borne water and electricity supply. FMC, Bida is a 200-bed tertiary hospital serving as a referral centre for all primary and secondary facilities in and around Niger State.

Sampling Methods

Subjects comprised of consenting HIV positive patients on HAART attending ART Clinic of FMC, Bida.

Inclusion Criteria

1. HIV positive patients referred to the ART Clinic of FMC, Bida that offered written informed consent.
2. HIV positive patients on HAART regime.
3. Subjects within the age range of less than 1 year to 70 years.

Exclusion Criteria

1. HIV Seronegative persons.
2. HIV positive patients referred to the ART Clinic who refused consent.

Ethical Consideration

Approval for this study was obtained from the Ethical Review Committee of Federal Medical Centre, Bida. The sample collection was explained to the subjects using the information sheet prepared by the researcher. Each subject was required to give a written informed consent before being eligible to participate in the study, while parents gave consent on behalf on their children. Proper permission was obtained from the coordinator of ART Clinic FMC, Bida.

Data Collection

A semi- structured questionnaire was used to collect necessary data. The questionnaire was administered by the researcher. The data to be obtained include socio-demographic characteristics, use of HAART, History of blood transfusion and CD_4^+ counts. Data from subjects were collated and analyzed

statistically. The data collected included socio-demographic data and results of CMV IgG and IgM (ELISA) test.

Specimen Collection

Five milliliters of whole blood were drawn from the median cubital vein of every volunteer into a plain tube and allowed to clot. Specimen was centrifuged at 3000 revolutions per mins (rpm) for 10 mins and were stored at $-20^{\circ}C$ for ELISA. Two milliliters of blood were collected in EDTA tube and used for CD_4^+ counts estimation.

Specimen Analysis

The frozen sera were thawed at room temperatures for 45 mins. Enzyme Linked Immunosorbent Assay (ELISA) IgG and IgM DIA Source (KAPRCVG01) CMV IgM and IgG kit were used following manufacturer's instruction. Spectrophotometry was carried out using STAT FAX 2100 ELISA reader at 630 nm wavelengths.

IgG and IgM ELISA

Principle of Test.

The KAPRCVG01 Cytomegalovirus IgG/IgM kit is based on the ELISA technique. In the assay, Calibrators and unknowns are incubated in micro titration wells coated with purified and inactivated CMV antigen. After incubation and washing, the wells were treated with the conjugate, composed of anti- human IgG/IgM antibodies labeled with the substrate tetramethylbenzidine (TMB). An acidic stopping solution was then added and the degree of enzymatic turnover of the substrate is determined by wavelength absorbance measurement at 450nm. The absorbance measured is directly proportional to the concentration of anti- CMV IgG/IgM antibodies present.

Preparation for Assay (IgG/IgM)

All kits reagents and specimens were brought to room temperature ($28^{\circ}C$) before use. Reagents and samples were thoroughly mixed by gentle inversion.

The same lots of kit component was used within an individual assay. Kit component beyond the

expiration date shown on its label was avoided. Incomplete washing was avoided to prevent adverse effect on the outcome and assay precision. To minimize potential assay drift due to variation in the substrates incubation time, care was taken to add the stopping solution into the wells in the same order and speed while the TMB chromogen solution was added. Microbial contamination of reagents, especially of the conjugate, wash buffer and diluents was avoided. Contamination of the TMB chromogen solution with conjugate was avoided. Clean disposable pipette tip for each reagent was used, pipette with metal parts was avoided. High quality water was used for the assay. Exposure of reagents to excessive heat or sunlight during storage and incubation was avoided.

Pre-Assay Procedure

Prior to commencing the assay, the distribution and identification plan for all specimens and controls was carefully established. The required number of microtiter wells was selected and inserted unto the holder. After having adequate number of wells for the number of samples, extra wells were provided for Blank, Standard and Control serum. All wells were properly labeled, a clean disposable pipette tip was used for dispensing each standard and sample. Samples were assayed in batches.

Preparation of Reagents

Washing Solution

The washing solution was diluted 1:10 with distilled water prior to use. Crystals when found were dissolved at 37°C before dilution. One hundred microliters of the washed concentrate was added into a clean container and diluted by adding 900 ml of distilled water. Mixed thoroughly by inversion. The washed solutions are stable for 5 days at room temperature and 2 weeks at 2-8°C when stored in a tightly sealed bottle.

Micro Titration Strips

The number of coated strips required for the assay was selected. The unused wells were placed in the pouch with a desiccant pack and sealed. The pouch was resealed to protect strips from moisture.

Assay Procedure

1. The required number of cavities was placed in the frame and a protocol sheet was prepared.
2. Samples were diluted 1:101, distributing ten microliters of sample into one milliliter of sample diluents.
3. One hundred microliters of each diluted sample and calibrators (0, 1, 2 and 3) were pipetted to the appropriate wells. One well was left for the substrate blank.
4. The micro plate was incubated for 45 mins at 37°C.
5. The micro plate was aspirated and each well was washed four times for 30 seconds with washing solution manually using a dispenser. Blotted and dried by inverting plate on absorbent material.
6. One hundred microliters of each Enzyme – Labeled 2nd Antibody was added into each well.
7. The micro plate was incubated for 45 mins at 37°C.
8. Each well was aspirated and washed four times for 30 seconds with washing solution manually using a dispenser. Blotted and dried by inverting plate on absorbent material.
9. One hundred microliters of TMB Chromatogen solution was added to each of the well using a dispenser.
10. Incubated for 15 mins at room temperature. Exposure to direct sunlight was avoided.
11. One hundred microliters of stop solution was added to each well using a dispenser.
12. The absorbance of the solution in the wells was read using a microplate reader set to 450 nm. If wavelength correction was necessary, the instrument was set to dual wavelength measurement at 450nm with background wavelength correction set at 600 or 620nm.

Results Interpretation

The mean absorbance for each calibrator and unknown were calculated.

Qualitative results:

Samples are positive for the presence of specific IgG/IgM if the absorbance of the samples is higher than Calibrator 1.



The ratio between the average OD value of the sample and that of Calibrator 1 was calculated. Samples were considered:

Positive: if the ratio is >1.1

Doubtful: if $\pm 10\%$ of the Cut –Off.

Negative: if the ratio is <0.9

Statistical analysis

Generated data from the study was entered into and analyzed with SPSS version 20.0. Data was summarized in frequency tables. Relationships and interactions among epidemiologic variables were determined using Chi-square crosstabs. Statistical significance tests were based on the 95 % Confidence Interval (CI), p -value of ≤ 0.05 .

Results

Three hundred and eighty-five (385) blood samples was collected among patients with HIV/AIDS attending ART Clinic in Federal Medical Centre, Bida. Subjects in this study were within the ages of less than 1 year to 70 years with a mean age of 37.04 ± 1.904 years.

The prevalence of CMV IgG and IgM report among HIV subjects in Bida is presented in Table 1. Out of the total three hundred and eight five (385) HIV seropositive subjects, 324(84.2%) was positive for anti-CMV IgG antibodies while 77(19.8%) was positive for anti-CMV IgM antibodies.

The age distribution of Cytomegalovirus IgG/IgM antibodies among HIV subjects tested for anti-CMV IgG/ IgM antibodies is presented in Table 2. The prevalence of anti-CMV IgG was higher in age group 30-39 years (88.2%) followed by age group 50-59 years (85.7%), 20- 29 years (84.2%) with the least (66.7%) found among 70 years. The study had no significant difference in anti-CMV IgG antibodies among the various age groups tested ($p = 0.923$). The prevalence of anti-CMV IgM was higher in age group 30-39 years (24.8%) followed by age group 10-19 years (21.0%), 20- 29 years (18.9%). There was no significant difference in anti-CMV

IgM antibodies among the various age groups tested ($p = 0.852$).

Gender distribution of CMV IgG/ IgM antibodies among HIV subjects is presented in Table 3. The prevalence of anti-CMV IgG was higher in males (84.0%) than the female counterparts (83.0%). There was no significant difference ($p = 0.852$) between CMV IgG antibodies seropositivity outcome and gender of the subjects. While the prevalence of anti-CMV IgM was higher in females (20.7%) than their male counterparts (16.0%), there was no significant difference ($p= 0.532$) between CMV IgM antibodies seropositivity outcome and gender of subjects.

The distribution of CMV IgG/IgM antibodies among HIV subjects based on the history of blood transfusion is presented in Table 4. Prevalence of IgG antibodies was higher in subjects with history of blood transfusion (94.6%) than those with no history of blood transfusion (83.0%). There was no significant difference ($p = 0.210$) in anti- CMV antibodies and blood transfusion in this study.

Prevalence of IgM antibodies was higher in subjects with history of blood transfusion (40.5%) than those with no history of blood transfusion (17.8%). There was no significant difference ($p = 0.071$) in anti-CMV IgM antibodies and blood transfusion in this study. $CD4^+$ counts distribution of Cytomegalovirus IgG/ IgM antibodies among HIV subjects tested for anti-CMV antibodies is presented in Table 5. The prevalence of anti- CMV IgG was higher among subjects with $CD4^+$ count <200 cells/ μ l (88.4%) than subjects with $CD4^+$ count >200 cells/ μ l (83.2%). There was no significant difference ($p = 0.435$) in the seropositivity outcome. The prevalence of anti-CMV IgM was higher among subjects with $CD4^+$ count <200 cells/ μ l (21.7%) than participants with $CD4^+$ count >200 cells/ μ l (19.6%). There was also no significant difference ($p= 0.809$) in the seropositivity outcome of anti- CMV IgM.

Table 1: Prevalence of Cytomegalovirus Infection among HIV Positive Patients on HAART in Bida.

Methods	No. Tested	No. Pos.	% Pos.
Serology			
IgG	385	324	84.2%
IgM	385	77	19.8%

Table 2: Age Distribution of CMV IgG /IgM Antibodies among HIV Positive Patients on HAART in Bida

Age(Years)	No. Tested	IgG No. (%) Positive	IgM No. (%) Positive
0-9	9	7 (77.8%)	2 (22.2%)
10-19	19	18 (73.7%)	4 (21.0%)
20-29	53	45 (84.3%)	10 (18.9%)
30-39	153	135 (88.2%)	38 (24.8%)
40-49	100	81 (81.0%)	16 (19.0%)
50-59	40	34 (85.7%)	6(15.0%)
60-69	8	6 (75.0%)	1 (12.5%)
70	3	2 (66.7%)	0 (0%)
Total	385	324(84.2%)	77(19.8%)

IgG $p = 0.923$

IgM $p = 0.852$

Table 3: Gender Distribution of CMV IgG/IgM Antibodies among HIV Positive Patients on HAART in Bida

Gender	No. Tested	IgG No. (%) Positive	IgM No. (%) Positive
Male	125	106 (84.8%)	21 (16.8%)
Female	260	218 (83.8%)	56 (21.6%)
Total	385	324 (84.2%)	77(19.8%)

IgG $p = 0.852$ *IgM* $p = 0.532$



Table 4: Distribution of CMV IgG Antibodies among HIV Positive Patients on HAART Based on History of Blood Transfusion

Transfusion History	No. Tested	IgG No. (%) Positive	IgM No. (%) Positive
Yes	37	35(94.6%)	15 (40.5%)
No	348	289 (83.0%)	62 (17.8%)
Total	385	324(84.2%)	77(19.9%)

IgG p = 0.210 *IgM p = 0.071*

Table 5: CD4⁺ Count Distribution of CMV IgG/IgM Antibodies among HIV Positive Patients on HAART in Bida

CD4 ⁺ Counts	Number Tested	IgG No. (%) Positive	IgM No. (%) Positive
< 200 cells/ μ l	69	61 (88.4%)	15 (21.7%)
>200 cells/ μ l	316	263 (83.2%)	62 (19.6%)
Total	385	324 (84.2%)	77(19.2%)

IgG p = 0.435 *IgM p = 0.809*

Discussion

The prevalence of CMV IgG among HIV/AIDS patients in this study was 84.2% (324). This finding compared well with the prevalence of 89.4% reported by Basawaraju *et al.* (2011) from HIV seropositive patients in Khammam, India. Ojide *et al.* (2013) in Benin City reported a prevalence of 98.8% while Farhad *et al.* (2010) in Iran reported 94%. In USA, Stove *et al.* (2003) reported a prevalence of 91.6%. Similarly, Wester *et al.* (2006) in Botswana and Akinbami *et al.* (2010) in Lagos Nigeria reported prevalence of reported 95.3% and 100% respectively. They all reported higher prevalence respectively compared to our result in Bida. However, Adjei *et al.* (2008) reported an unusually low prevalence of 59.9% in Ghana.

This study reported a specific CMV IgM antibodies prevalence of 19.8%. The prevalence reported in Bida was one of the highest reported among HIV patients in recent times compared to other reports in other developing countries. A prevalence of 9.52% was reported by Basawaraju *et al.* (2011) from HIV

seropositive patients in Khammam India, while Ojide *et al.*, (2013) in Benin City reported 7.0%, Musa *et al.* (2003) in Kano reported 13.0% and Akinbami *et al.* (2010) in Lagos reported 6.6%. All researchers reported a lower prevalence compared to 19.8% in our findings in Bida. The high distribution of IgM seropositivity is a clear reflection of high level of reactivation of CMV in HIV positive patients. Low socio economic and high level of polygamous settings are some possible key factors responsible for this outcome. However, Chakravarit *et al.* (2009) observed that CMV active infection might be a marker of extremely severe immunosuppression, which may ultimately lead to fatal outcome in HIV patients and the presence of IgM antibodies may be due to primary infection, reactivation or re-infection by CMV.

The findings in this work showed that the seropositivity of anti-CMV IgG antibodies was age-dependent as IgG antibodies were not found to be the same or in any pattern of increase in all the age groups. The highest prevalence was found in age

groups 30-39 years (88.2%) with the least in 70 years (66.6%). Our finding is in agreement with previous report by Fowotade *et al.* (2015) who reported an age dependent prevalence but in contrast with the findings of Ojide *et al.*(2013) and Farhad *et al.*(2010) who both reported a gradual increase of the prevalence of CMV IgG antibodies with age among HIV patients with 100% prevalence in older ages of 60 years and above. The age- related distribution of anti- CMV IgG showed no significant difference between age and CMV IgG antibodies in this study ($p= 0.923$) which agreed well with Ojide *et al.* (2013) and Farhad *et al.* (2010) but in contrast with Fowotade *et al.* (2015) who found a significant relationship with IgG and age in Ilorin Nigeria. However, it was observed that there are three peaks for acquisition of CMV infection namely; infancy, early childhood and early adulthood.

Seroprevalence of CMV IgM antibodies was also found to be age- dependent. IgM antibodies was not found to increase or decrease in any particular order among the various age groups. The highest prevalence was however seen in age group 30-39 years (24.8%) followed by 10-19 years (21.0%) and the least found among age group 70 years (0%). Our finding is in agreement with previous report by Fowotade *et al.* (2015) who reported an age-dependent prevalence but in contrast with Musa *et al.* (2003) in Kano who reported a gradual decrease in prevalence with increase in age with the highest found in age group 21-30 years (4.8%) and least at 70 years (0%). The age-related distribution of CMV IgM antibodies among HIV seropositive patients in Bida had no significant difference ($p = 0.852$) among various age groups. These were reflected in previous studies that CMV infection occurs worldwide and about four out of five people over age 35 years have been infected with cytomegalovirus usually during childhood (Fowotade *et al.*, 2015).

Gender- related distribution of CMV IgG among HIV seropositive patients in this study showed higher prevalence in males (84.8%) than females (83.8%). This agreed with Farhad *et al.* (2010) and Fowotade *et al.* (2015) who both reported higher prevalence in male than in females but in contrast with Ojide *et al.* (2013) who reported higher

prevalence in females in Benin City. However, there was no significant difference between gender and CMV IgG among HIV subjects in Bida. It can be deduced from this study that CMV IgG distribution is not gender dependent among HIV subjects. Existing evidence suggested that the concentration of IgG immunoglobulin's in maternal and cord sera are essentially the same (Peter and Richard, 1966).

Gender distribution of CMV IgM among HIV seropositive subjects was found to have a high prevalence among females (21.5%) than males (16.8%). This agreed well with Musa *et al.* (2014) in Kano and Ojide *et al.* (2013) in Benin City who both reported a high prevalence in females than males but in contrast with Fowotade *et al.* (2015) in Ilorin who reported higher prevalence of CMV IgM among HIV patients in males (13.9%). Preponderances of CMV IgM positivity among females could be explained by the fact that they probably had more contact with babies as urine and infected children are significant sources of CMV infection (Lazzarotto *et al.*, 2011). However, there was no significant difference between gender and CMV IgM among HIV subjects in Bida.

CMV infection constitutes a real risk of pathogenicity in immunocompromised patients as it is likely that HIV- infected patients who developed CMV infection may have a previous history of blood transfusion (Akinbami *et al.*, 2010). This study found no significant difference between history of blood transfusion and CMV IgG, but the prevalence in IgG was higher (94.6%) in patients with history of blood transfusion than in those subjects without history of blood transfusion (83.0%). This finding is at variance with previous reports by Akinbami *et al.* in Lagos and Fowotade *et al.* (2015) who reported a 93.6% prevalence in patients with no history of blood transfusion in Ilorin. It was observed that previous blood transfusion was a risk factor for CMV antibody production among HIV patients in Bida.

CMV – specific antibody of the IgM class is a marker of active or recent primary infection with the virus. HIV- infected patients who require transfusion are at high risk of developing symptomatic CMV infection when transfused with CMV infected donor



blood (Akinbami *et al.*, 2010). The prevalence of IgM was higher (40.5%) in subjects with history of blood transfusion than the 17.8% prevalence in subjects without history of blood transfusion. This finding is in agreement with Fowotade *et al.* (2015) who reported a high prevalence in subjects with history of blood transfusion in Ilorin. There was no significant difference between history of blood transfusion and CMV IgM in this study. Previous blood transfusion was a risk factor for CMV IgM antibody production among HIV patients in Bida.

This study evaluated the seroprevalence of CMV IgG in different CD4⁺ count cells groups (< 200cells/μl and > 200 cells/μl). It was revealed that the prevalence of CMV IgG antibodies was higher (88.4%) in subjects with CD4⁺ count cells < 200cells/μl than >200cells/μl (83.2%). However, Ojide *et al.* (2013) and Farhad *et al.* (2010) reported a similar prevalence among subjects with low and high CD4⁺ counts. There was no significant difference found between CMV IgG positivity and CD4⁺ count of subjects in Bida.

With reference to the immune status of the study subjects, this study found a higher prevalence of IgM antibodies (21.7%) in patients with CD4⁺ count < 200 cell/μl. However, with a prevalence as high as 19.6% for subjects with moderate and high CD4⁺ count (>200 -1000 cell/μl) when compared with those with CD4⁺ count < 200 cell/μl. This finding showed that subjects with CD4⁺ count of 200 and above are also susceptible and have high chances of developing reactivation of CMV in HIV. This finding is in agreement with Farhad *et al.*, (2010) who reported some HIV positive patients with relatively high CD4⁺ counts who had IgM antibodies similar to those with low CD4⁺ count. This study revealed that CD4⁺ count <200 cell/μl was a risk factor for acquiring primary CMV infection in HIV patients. As it was found in this study, the prevalence of CMV primary infection in HIV positive patients in Bida are close in different levels of CD4⁺ groups and there was no significant difference between IgM antibodies and CD4⁺ counts. However, Ojide *et al.* reported a very high prevalence of IgM among subjects with CD4⁺ count <200 cell/μl (10.9%) in Benin City.

Conclusion

This study revealed an overall prevalence of 83.3% IgG and 19.2% IgM CMV infection. Previous history of blood transfusion and CD4⁺ count <200 cell/μl are risk factors of primary infection in patients with HIV/AIDS attending ART clinic of Federal Medical Centre, Bida.

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