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Cytomegalovirus co-infection with HIV in children and adolescents on antiretroviral therapy in Abuja, Nigeria

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Abstract:

Background: Cytomegalovirus (CMV) co-infection with human immunodeficiency virus (HIV) is known to accelerate HIV disease progression. It has the potential of being a killer disease or a silent lifetime companion in HIV patients. There is dearth of information on CMV prevalence among HIV infected children and adolescents in our environment. We therefore conducted this study to determine its sero-prevalence, and risk factors for co-infection among HIV infected children and adolescents on highly active antiretroviral therapy (HAART) in our center.
Method: A descriptive cross sectional study of HIV-infected children and adolescents aged 2 months to 18 years on HAART was conducted over a 6 month period between October 2017 and March 2018 in our health facility. Blood samples of subjects were screened for CMV IgM using commercial test kits. Biodata of subjects, CD4 cell count, and viral load were collected into a designed proforma, and statistical analysis was done with SPSS version 22.0.
Result: A total of 161 HIV-infected children and adolescents were recruited, 103 (64.0%) were males, 83 (51.6%) were between the ages of 5 and <10 years, 113 (70.2%) were from lower socio-economic class, and 138 (85.7%) were on 1st line HAART. Of the 17 (10.6%) subjects positive for CMV IgM, 3 (17.6%) were less than 5 years old, 11 (64.7%) were between the ages of 5-10 years, and none was older than 15 years. Univariate analysis showed significant differences in the mean age, weight, length/height, and systolic blood pressure between CMV IgM positive and negative patients ($p<0.05$), but no significant difference in gender, socioeconomic class, types of antiretroviral drugs, CD4 cell count, and viral load ($p>0.05$). Multivariate analysis however did not show any significant difference in age, weight, length/height, and systolic blood pressure.
Conclusion: The prevalence of active CMV infections among HIV infected children and adolescents on HAART in our centre is high. Low CD4 cell count and high viral load were not associated with active CMV disease, and no risk factor for co-infection was also identified. Identifying those with primary/active infection will be necessary for possible treatment with anti-herpes drugs before development of reactivated CMV disease.

Keywords: CMV; HIV; co-infection; anti-retroviral; children; adolescents

Co-infection par le cytomégalovirus et le VIH chez des enfants et des adolescents sous traitement antirétroviral à Abuja, au Nigéria

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Abstrait:

Contexte: On sait que la co-infection par le cytomégalovirus (CMV) et le virus de l'immunodéficience humaine (VIH) accélère la progression de la maladie. Il a le potentiel d'être une maladie mortelle ou un compagnon

silencieux à vie chez les patients VIH. Il existe peu d'informations sur la prévalence du CMV chez les enfants et les adolescents infectés par le VIH dans notre environnement. Nous avons donc mené cette étude pour déterminer sa séroprévalence et les facteurs de risque de co-infection chez les enfants et les adolescents infectés par le VIH sous traitement antirétroviral hautement actif (HAART) dans notre centre.

Méthode: Une étude transversale descriptive des enfants et adolescents infectés par le VIH et âgés de 2 mois à 18 ans sous multithérapie a été menée sur une période de 6 mois entre octobre 2017 et mars 2018 dans notre établissement de santé. Des échantillons de sang de sujets ont été testés pour l'IgM de CMV en utilisant des kits de test commerciaux. Les données biologiques des sujets, le nombre de cellules CD4 et la charge virale ont été recueillis dans un formulaire conçu à cet effet et une analyse statistique a été réalisée avec SPSS version 22.0.

Résultat: 161 enfants et adolescents infectés par le VIH ont été recrutés, dont 103 (64,0%) étaient des hommes, 83 (51,6%) étaient âgés de 5 à moins de 10 ans, 113 (70,2%) étaient issus de milieux socio-économiques inférieurs. et 138 (85,7%) suivaient la multithérapie de première ligne. Sur les 17 (10,6%) sujets positifs pour l'IgM du CMV, 3 (17,6%) avaient moins de 5 ans, 11 (64,7%) étaient âgés de 5 à 10 ans et aucun n'avait plus de 15 ans. Une analyse univariée a montré des différences significatives dans l'âge moyen, le poids, la taille / taille et la pression artérielle systolique entre les patients positifs et négatifs pour IgM anti-CMV (*p*<0,05), mais aucune différence significative entre le sexe, la classe socio-économique, les types de médicaments antirétroviraux et les cellules CD4 nombre et charge virale (*p*>0,05). L'analyse multivariée n'a cependant montré aucune différence significative d'âge, de poids, de taille / taille et de pression artérielle systolique.

Conclusion: La prévalence des infections à CMV actives chez les enfants et les adolescents infectés par le VIH sous HAART dans notre centre est élevée. Un faible nombre de cellules CD4 et une charge virale élevée n'étaient pas associés à la maladie à CMV active et aucun facteur de risque de co-infection n'a également été identifié. Identifier les personnes présentant une infection primaire / active sera nécessaire pour un traitement éventuel avec des médicaments anti-herpès avant le développement d'une maladie à CMV réactivée.

Mots-clés: CMV; HIV; co-infection; anti-rétroviral; Enfants; les adolescents

Introduction:

Cytomegalovirus also known as human herpes virus (HHV) 5 is one of the eight HHVs, belonging to beta herpesvirus subfamily. Infection is ubiquitous, and generally asymptomatic in healthy children and adults. Infants usually acquire the infection while in the uterus, during passage through the birth canal, or through breast milk. Young children are frequently infected by contaminated saliva when sucking and sharing toys. The virus can also be contacted through respiratory routes, pharyngeal secretions, tears, urine, faeces, seminal and vaginal fluids, during blood transfusion, organ transplant, or through sexual contact (1). Infection is largely contacted during childhood or during sexual activities in human population worldwide with some regional variations (1). Following primary infection, the virus becomes latent in a few cells in its episomal form (2). Reactivation with viral shedding occurs when immunity is compromised as seen in HIV co infection (2).

CMV is widely recognized as an opportunistic pathogen causing severe opportunistic infections in immuno-compromised individuals which generally manifests as retinitis with high tendency to cause rapid loss of vision, chronic crippling diarrhea, central nervous system diseases and sudden loss of neurologic function, and pneumonia (3, 4). CMV active infection might be a marker of extremely severe immunosuppression that can ultimately lead to a fatal outcome in immuno-compromised individual. Primary CMV infection occurs in a previously sero-negative individual and can be a potential killer in such individual, whereas secondary infection which is intermittent excretion of the virus in the presence of host immunity may be due to either reactivation of an endogenous virus or exposure to a new virus strain from an exogenous source. (5). Hence the presence of the IgM antibodies may be due to primary/active infection or re-infection (6).

Persistent immune activation is hallmark of human immunodeficiency virus infection, and in co-infected individual, CMV-induced T cell activation potentially contributes to increased HIV disease progression (7). The two viruses while infecting a number of similar cell types such as the endothelium of blood vessels, mononuclear cells, white blood cells, and epithelial cells, also interact through transactivation, secretion of cytokines that reactivate provirus, or increase in HIV tropism through CMV expression of receptor analogues or by formation of pseudoviruses (8). HIV infection induces immunosuppression through depletion of CD4 cell count with increasing CMV reactivation, the reactivation promote HIV replication through a complex interaction with the long terminal repeat region, transactivation of proviral HIV, release of inflammatory cytokines and chemokines, and up-regulation of CCR5 expression in central memory T cells (9-11). During the era of antiretroviral therapy (ART), accumulated data in adults suggests that CMV co-infection with HIV contributes

significantly to the accelerated HIV disease progression and development of non AIDS-defining comorb- idities (12-17). The complex interplay of these two chronic viral infections continues to be potentially significant especially in highly endemic area of sub-Saharan Africa, where both viruses are endemic (18).

In industrialized countries such as USA, Australia and Europe, CMV sero-prevalence among adult population is between 36 and 77%, in contrast to highly endemic areas of sub-Saharan Africa, where sero-prevalence approaches 100% (19). There is serological evidence of CMV infection in almost two thirds of infants from African origin by 3 months of age, and 85% are infected by a year (20). Among HIV-infected children in Africa, the majority are co-infected with CMV by their first birthday (20) and almost all by the time they reach their teens, in contrast to what is seen in industrialized nations (7, 21).

Antibody testing can be used to determine recent or past exposure to CMV infection. The first antibody to develop in response to CMV infection is IgM. This develops within a few days following primary infection. While CMV IgM remains detectable for six to nine months in the blood, medium to high levels of CMV IgM can be detected during the first three months of a primary infection. IgM is also detected during secondary infections either as re-activation or re-infection. By assessing the presence of IgM in a sample, active CMV infection can be ascertained. This study was therefore condu-cted to determine the prevalence of active CMV infection in HIV infected children and adolescents on ART in our health facility. The study also aimed to determine the risk factors for acquisition of the CMV, and the effects of co-infection on CD4 cell count and viral load of HIV patients.

Materials and method:

Study setting and design

A cross sectional hospital based study was conducted at the Paediatric Out-patient Special Treatment Clinic (POSTC) of the University of Abuja Teaching Hospital (UATH) over a 6 months period from October 2017 to March 2018. POSTC is an arm of out-patient service area of department of paediatrics where HIV infected children/adolescents and exposed babies are seen and followed up for treatment/monitoring. The clinic is opened for services from Monday-Friday, and from 7.30 am to 4 pm. UATH is a 350 bed capacity referral hospital, sub-serving the people of Federal Capital Territory (FCT) Abuja and neighbouring states of Nassarawa, Kogi, Kaduna, and Niger States. It is one of the first centers since 2005 to start offering free HIV/AIDS services in the country through the President Emergency Plan for AIDS Relief (PEPFAR) and the Federal Government of Nigeria (FGN).

Subjects

The subjects were paediatric patients' 2 months to 18 years old tested positive for HIV by either serological method or by polymerase chain reaction (PCR) test and started on anti retroviral therapy (ARV) therapy. Consecutive eligible children and adolescents attending the POSTC were recruited and subsequently enrolled into the study after parents/caregivers provided written informed consent and children 7 years and above provided assent for the study. Inclusion criteria for the study were; HIV infected children and adolescents aged 2 months to 18 years on ARV therapy, parents/caregivers and older children accepting to be part of the study. Exclusion criteria included those unwilling to participate in the study, and exposed uninfected infants. Ethics clearance was obtained from the ethics committee of the hospital before the commencement of the study.

Clinical data and sample collection

Clinical and physical examination were carried out after enrollment by the attending physician. The demographic characteristics of the subjects were collected which included age, gender, religion, and socio economic statue (SES) of the parents. Using a vaccutainer needle, three milliliters (3 mls) of venous blood was collected from each subject and transported to the laboratory for analysis. In addition, the weight, blood pressure, CD4 cell count, and viral loads (VL) were retrieved from the patient's information record if done within 1 month of the study or if not, they were freshly performed.

Laboratory analysis

The serum was separated by centrifugation at 3500 rpm for 5 minutes and refrigerated (2-8°C) until analysis was done. At the time of analysis, the serum was carefully removed using a fine bore pipette to avoid extracting red cells and the test device removed from the sealed pouch. Screening for CMV IgM was done using commercial fortress diagnostics[R] (CMV IgM) ELISA immunoassays

kits. The clinical sensitivity and specificity of the Cyto IgM ELISA kits was 99.6% on plasma and sera. The cut-off optical density (O.D) was obtained in accordance with the manufacturer's instructions; the CMV index of the samples was calculated by dividing the O.D value of each of the samples with the obtained Cut-off O.D values. OD interpretation was CMV index of <0.90 as negative and CMV index of 1.0 and above as positive.

CD4 cell count was measured using automated Partec Cyflow easy count kit (Partec code no. 05-8401 Western Germany), Viral load (VL) measurement was performed with Roche Smp/prep/cobs Taqman 96, USA, and Seca beam weighing scale was used to accurately measure weight to the nearest 0.01kg.

Data analysis

Data analysis was done using SPSS version 22.0, and percentage, means and standard deviations were calculated for the variables. The test for association was done using student t-test for continuous variables and Chi-square or Fisher's exact test for categorical variables where applicable. Multivariate logistic model was used to determine associated risk factors of CMV co-infection with HIV, unadjusted and adjusted odds ratio (OR) were reported, and p value of <0.05 was considered significant.

Results:

Table 1 shows the demographic and clinical characteristics of the study population. Of a total of 161 HIV infected children and adolescents screened for CMV IgM antibody, 103 (64.0%) were males, 83 (51.6%) were between the ages of 5-10 years, 110 (68.3%) were Christians, 113 (70.2%) were from low socio-economic class and 138 (85.7%) were on 1st line HAART. The mean body weight, CD4 cell count and VL were 30.0±12.4 kg, 979.5±457.7 cells/µl, and 9,136.1±306.0 copies/ml. There was no significant difference in the demographic characteristics between the male and female populations (p>0.05 for all the variables).

Table 2 shows the association of CMV IgM antibody and the co-variables. Seventeen (10.6%) of the 161 patients screened tested positive for the IgM antibody, while 144 (89.4%) were negative. Three (17.6%) of those tested positive were less than 5 years, 11 (64.7%) were between the ages of 5 and <10 years, and none was older than 15 years. On univariate analysis, significant difference

was observed in mean age (p=0.025), body weight (p=0.004), length/height (p=0.039), and systolic blood pressure (p=0.001) between those who tested positive and negative for the CMV IgM. On multivariate logistic regression, none of the associated factors (age, body weight, length/height, and systolic blood pressure) showed significant association with CMV infection (p>0.05) (Table 3).

Although there were more male subjects (10, 58.8%), subjects in the age range of 5-<10 years (11, 64.7%), Christians (9, 52.9%), subjects from low socio-economic class (16, 94.1%), and subjects on 1st line ART (15, 88.2%) who tested positive for CMV IgM, the difference was not significantly different from CMV IgM negative subjects (p>0.05 for all the variables). Similarly, there were no statistically significant differences for other parameters; CD4 cell count, VL, BMI, ART duration, and diastolic blood pressure between those positive and negative for CMV IgM (p>0.05 for all variables).

Table 4 depicts the different values of CD4 cell count and VL in relation to CMV IgM positivity and negativity. Only 1 (5.9%) patient with CD4 cell count of <200 cells/µl and 2 (11.8%) with VL of >1000 copies/ml tested positive for CMV IgM. There was no significant difference in the values of CD4 cells and VL between CMV IgM positive and negative patients (p>0.05).

Discussion:

The prevalence of active or primary CMV infection in HIV infected children and adolescents on highly active anti-retroviral therapy (HAART) in this study, was 10.6%. This was comparable to 13% among HIV infected adolescents and adults from Kano by Musa et al., (22), 9.5% among AIDS patients from India by Basawaraju et al., (23) and 11.4% among infected prison inmates by Neusa et al., (24) in Brazil. The rate in our study is however much lower than 58.3% reported among HIV-infected infants initiated on ART in Cameroun by Kfutwah et al.,(26), 28% by Oladipo et al., (27) among blood donors in Nigeria, and 14% among HIV patients by Tsertsvadze et al., (28). The prevalence rates of 3.5% (29), 4.5% (30), 6.6% (31), 7.0% (32), 8.1% (33), and 8.4% (25) from various studies in Nigeria, Qatar, and Kenya were lower than the 10.6% recorded in this study. Although most of these referenced studies were from adult population, pregnant women and blood donors, with only two from HIV children and adolescents, the

Table 1: Demographic and clinical characteristics of HIV-infected children and adolescents in University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria

Characteristics of subjects	Male (%)	Female (%)	Total (%)	*p* value
No of subjects	103 (64.0)	58 (36.0)	161 (100)	0.64
Age group (years)				
<5	11(10.7)	2 (3.4)	13 (8.1)	
5-<10	52 (50.4)	31 (53.4)	83 (51.6)	
10-15	32 (31.1)	21 (36.2)	53 (32.9)	
>15	8 (7.8)	4 (6.9)	12 (7.4)	0.423
Religion				
Christianity	74 (71.8)	36 (62.1)	110 (68.3)	
Islam	29 (28.2)	22 (37.9)	51 (31.7)	0.201
Socio-economic class				
High	11 (10.7)	5 (8.6)	16(9.9)	
Middle	22 (21.4)	10 (17.2)	32(19.9)	
Low	70 (67.9)	43 (74.1)	113(70.2)	0.764
1st or 2nd line ARVT				
1st Line	89 (86.4)	49 (84.5)	138(85.7)	
2nd Line	14 (13.6)	9 (15.5)	23(14.3)	0.738
ARVT duration (years)*	6.7±3.3	7.0±3.5	6.9±3.4	0.695
Wt, CD4 and Viral Load*				
Weight (kg)	29.9±12.2	30.1±12.5	30.0±12.4	0.962
CD4 (cells/µl)	904.8±139.5	1054.1±75.9	958.6±37.8	0.058
Viral Load (copies/ml)	18507.9± 440.6	6206.6±343.4	9136.1±306.0	0.314

ARVT = Antiretroviral therapy; Wt = weight; *=mean values; CD = clusters of differentiation

Table 2: Clinical variables in HIV-infected children and adolescents with CMV co-infections in University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria

Clinical and associated risk factors/variables	CMV positive (%)	CMV negative (%)	Total (%)	X^2	*p* value
Subjects	17 (10.6)	144 (89.4)	161 (100)		
Age Group (years)					
<5	3 (17.6)	10 (6.9)	13 (8.1)	5.558	0.135
5-<10	11 (64.7)	72 (50.0)	83 (51.6)		
10-15	3 (17.6)	50 (34.7)	55 (34.2)		
>15	0	12 (8.3)	16 (9.9)		
Gender					
Male	10 (58.8)	93 (64.6)	103 (63.9)	0.98	0.647
Female	7 (41.2)	51 (35.4)	58 (36.0)		
Religion					
Christianity	9 (52.9)	101 (70.1)	110 (68.3)	2.078	0.149
Islam	8 (47.1)	43 (29.9)	51 (31.7)		
Socio-economic class					
High	0	16 (11.1)	16 (9.9)	0.912	0.634
Middle	1 (5.9)	31 (21.5)	32 (19.9)		
Low	16 (94.1)	97 (67.4)	113 (70.2)		
Types of ARV Drugs					
1st line	15 (88.2)	123 (85.4)	138 (85.7)	0.099	0.753
2nd line	2 (11.7)	21 (14.5)	23 (14.3)		
Co-variables*	**CMV positive (%)**	**CMV negative (%)**	**Mean value**	**T- test**	**p value**
Age (years)	7.65±3.1	10.13±4.4	9.93±4.3	3.64	0.025**
ARV duration (years)	5.41±3.1	6.97±3.4	6.2±3.3	1.81	0.074
Weight (kg)	22.0±5.5	31.0±12.5	26.5±9.0	5.14	0.004**
Length/height (cm)	125.3±12.3	135.7±20.0	130.5±16.2	3.28	0.039**
BMI (kg/m^2)	13.9±1.9	16.9±7.9	15.4±4.9	0.711	0.164
Systolic BP (mmHg)	86.2±9.7	94.1±9.4	90.2±9.6	6.39	0.001**
Diastolic BP (mmHg)	53.5±7.8	57.2±9.4	55.4±8.6	0.64	0.119
CD4 (cells/µl))	919.6±34.1	1009.9±23.7	958.6±37.8	0.69	0.144
Viral Load (copies/ml)	10562.8±357	14491.±774.1	9136.1±306.0	0.87	0.837

ARV= antiretroviral therapy, *= mean values; ** = significant difference; X^2 = Chi square value

Table 3: Multivariate logistic regression of associated risk factors for CMV infection in HIV-infected children and adolescents in University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria

Variables	Unadjusted OR (95 % CI)	*p* value	Adjusted OR (95% CI)	*p* value
Age	0.7 - 0.975	0.017	0.85 - 1.17	0.954
Constant		0.545		0.924
Weight	0.85 - 0.974	0.007	0.69 - 0.99	0.055
Constant		0.685		0.924
Length/Height	0.95 - 0.99	0.049	0.98 - 1.146	0.094
Constant		0.501		0.924
Systolic Blood Pressure	0.86 - 0.968	0.002	0.88 - 1.015	0.118
Constant		0.020		0.924

OR = odd ratio; CI = confidence interval

Table 4: CD4 cell count and Viral Load of HIV infected children and adolescents with CMV IgM in University of Abuja Teaching Hospital, Gwagwalada, Abuja, Nigeria

Variables	CMV IgM positive (%)	CMV IgM negative (%)	Total (%)	X^2	*p* value
CD4 cell count (cells/µl)					
<200	1 (5.9)	2 (1.4)	3 (1.9)	2.631	0.268
200-500	1 (5.9)	22 (15.3)	23 (14.3)		
> 500	15 (88.2)	120 (83.3)	135 (83.8)		
Viral Load (copies/ml)					
< 20	10 (58.8)	65 (45.1)	75 (46.6)	1.389	0.499
20 - 1000	5 (29.4)	48 (33.3)	53 (32.9)		
> 1000	2 (11.8)	31 (21.5)	33 (20.5)		

CD = clusters of differentiation; CMV = cytomegalovirus; IgM = immunoglobulin M; X^2 = Chi square

differences however might not be unrelated to geographical locations of the studies, study populations, ethnic, social, cultural, and economic differences, and different sensitivity of the IgM screening tests used (34).

The high prevalence of active CMV infection in HIV children and adolescents in our study could signify either high level of primary infection or new strain of reactivated infections. This should be worrisome in this highly endemic area where vaccines for CMV have not yet been developed. However, the fact that all the patients in this study were on HAART with no clinical evidences of severe immune suppression such as retinitis, chronic crippling diarrhea, or other features of AIDS from CMV co-infection may suggest other associated factor(s) in the etiology of co-infection. Akinbami et al., (29) and Klatt and Shibata (36), however attributed such clinical manifestations of co-infection to reactivation of previous CMV infection rather than primary infection.

Our study showed non-statistically significant higher prevalence rate of CMV IgM in the male than female subjects, which is similar to the observations of Ojide et al., (31) and Fowotade et al., (35) among their HIV-infected adults cohort. Musa et al., (22) however had a contrary observation in Kano where they reported more female patients living with HIV having significantly higher CMV IgM than their male counterparts (8.7% vs 4.3%, *p*<0.01) although no reason for such finding was proffered. Udeze et al., (37) equally found significantly higher primary/ active CMV IgM among males than females HIV-infected children and adults on ART in their study cohort in Ilorin, and attributed such findings to more exposure of males to factors that lead to re-activation or re-infection of CMV in their locality.

There was also non-statistically significant highest prevalence of CMV IgM among subjects in 5-<10 year age group (64.7%) when compared to other paediatric age groups in this study (*p*=0.135). This is the period when parents usually send their children to day care services, nursery or primary schools. CMV transmission among children in

day care centers may be enhanced as a result of poor hand hygiene practices and overcrowding usually seen in such care centres (38). Exposure of children to such centers therefore increase the risk of CMV cross infection from school mates. Other studies however have shown significant association between prevalence of active CMV infection and other age groups (35, 37). In the study by Udeze et al., (37), higher IgM was significantly observed among children in age group ≤20 years (*p*=0.047) among their HIV cohorts aged 1 to 70 years on ART studied at Ilorin. The authors attributed such significant positive findings to the lower level of education and engagement in risky sexual behaviours in the age group but because the study did not separate the children into different paediatric age groups, it was difficult to appreciate which particular age group among the children had the highest prevalence of CMV IgM. CMV infection is ubiquitous with primary/active infection occurring commonly during childhood or adulthood in 4 out of every 5 person above 35 years old, but the infection is usually very mild and generally unrecognized (39).

Many previous studies identified low socio-economic class (SEC) as a risk factor for CMV infection (6,15,17). Our study however showed no significant association between low SEC and CMV IgM in the children and adolescents (*p*=0.634). Basha et al., (40) equally observed no significant association between CMV sero-prevalence and SEC (*p*=0.58) in their prospective cohort of non HIV Australian children aged 0-15 years. They however reported more congenital CMV in individuals with high SEC (55%) than the low SEC (9%) (*p*<0.001). Our study shows significant association between CMV IgM with respect to mean age, mean body weight, length/height and mean systolic blood pressure in the univariate analysis. These significant findings were not surprising considering that IgM were seen in younger age groups (none seen in >15years), and these variables were all age dependent. However on multivariate logistic analysis, all these variables were not statistically significant.

Low CD4 cell count in HIV infected person and high VL are indications of poor immunity and inadequate viral suppression. Although the prevalence of CMV IgM was higher among patients with high CD4+ cell counts and low VL in our study, this surprisingly, was not statistically significant. Similar studies in Benin (31) and Ilorin (37) in Nigeria, and in Iran (41) also found no statistically significant association between

CD4+ cell count values and prevalence of CMV IgM in their study populations, and adduced such findings to the effects of ART and duration of treatment. Patients in the present study had mean CD4 cell count and ART treatment duration of 958.6±37.8 cells/µl and 6.9±3.4 years respectively, indicating adequate immune response and long duration on ART. Going by the suggestion of Ojide et al., (31) and Udeze et al., (37), the good immunological response of patients in our study and their long duration on ART could possibly explain the non-significant association between prevalence of CMV IgM and CD4 cell count and VL. However, many other studies have shown prevalence of CMV IgM to be significantly associated with CD4 cell count (22, 40, 41). Although significant association was observed between CD4 cell count and prevalence of CMV IgM among HIV infected patients in the study by Musa et al., (22), the authors noted that there was no positive correlation between CD4 cell count and the prevalence of CMV IgM.

Conclusion:

Our study reports high prevalence of CMV IgM, indicating active/primary CMV infection among HIV infected children and adolescents on HAART. This prevalence was not significantly associated with low CD4 cell count, high VL or any risk factor. Identifying those with primary/active infection is nec-essary for possible treatment with anti-herpes drugs before development of reactivated CMV disease.

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