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SEROEPIDEMIOLOGICAL ANALYSIS OF CURRENT HUMAN CYTOMEGALOVIRUS INFECTIONS AMONG HIV-INFECTED INDIVIDUALS ATTENDING A HOSPITAL IN RIVERS STATE, NIGERIA

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ABSTRACT: The human Cytomegalovirus (HCMV) is an important opportunistic pathogen that accelerates disease progression in HIV-infected individuals globally, which contributes to a high rate of morbidity, mortality, HIV acquisition and disease progression. This qualitative cross-sectional study analysed plasma samples from 93 HIV positive subjects visiting a health institution in Rivers State, Nigeria. The study aimed to investigate the burden and associated factors of human cytomegalovirus (HCMV) co-infection among HIV-infected individuals in Rivers State. Plasma samples were screened via serology for the presence of specific HCMV IgG and IgM antibodies using ELISA kits. Socio-demographic characteristics of the subjects were collected using a structured questionnaire. Data were analysed statistically using frequency tables, charts and Chi-square where applicable. Of the 93 subjects, only 4(2.20%) were seropositive for HCMV IgM antibodies. No statistical association existed between the prevalence of HCMV IgM antibodies and the most socio-demographic factors (age, gender, education, occupation and marital status), except for Religion and ART use (2.2%), which were significantly associated. Low prevalence of HCMV IgM antibodies was found in the age group 25-44 years (1.08%), both genders had 1.08% each, married ones 3(1.61%), no education (1.08%), employed (1.08%), Christians (2.20%) and ART use (2.20%). The low seropositivity of HCMV IgM antibodies in this study is an indication that there is an active HCMV infection among the study population, although not high, which still necessitates the need for serological evaluation in all HIV-infected individuals to avoid the spread of HCMV coinfection.

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1. Introduction

The Human Immunodeficiency Virus (HIV) is immunosuppressive. it weakens the immune system and facilitates the advancement of HIV infection to AIDS (acquired immunodeficiency syndrome) in the absence of treatment. HIV-1 remains a major health concern, particularly in West and Central Africa. When HIV is present, inflammation thrives. New research suggests that persistent coinfections, like HCMV, might lead to a vicious cycle of immune activation and reservoir seeding (Maidji et al., 2017). Human cytomegalovirus (HCMV) is one of the highly prevalent human herpesviruses that cause OIs in HIV patients. Although it has a global endemicity, it is more widespread in developing countries than in developed countries (Kiros et al, 2021). The HCMV can ordinarily be contained by the cellular immune response and hence is often categorised as a self-limiting infection in healthy individuals (Okonko et al., 2023).

According to Perrello et al. (2019), HCMV is a factor that accelerates the course of HIV illness and is linked to immune activation and inflammation in people living with HIV. Both HIV and cytomegalovirus are known to cause inflammation and premature ageing in infected persons (Effros, 2015).

Depending on the person's immunological state, HCMV may cause modest to severe difficulties in their clinical presentations. Symptoms that are similar to mono may manifest in a variety of ways, including but not limited to: exhaustion, lack of appetite, swollen liver or spleen, sore throat, enlarged lymph nodes, fever, and malaise. Loss of appetite, yellow eyes, nausea, and diarrhoea are some of the symptoms and

indicators that may be associated with hepatitis. Retinitis, encephalitis, colitis, inflammation of the liver, heart, and brain, among other disorders, may be caused by it in patients with impaired immune systems. It affects almost every organ in the body. Among HIV-infected patients with advanced illness, CMV retinitis is the most prevalent HCMV manifestation; it is responsible for 85% of all CMV complications and causes blindness in many people (Edwin et al., 2021; Gianella & Letendre, 2016).

This study explored the prevalence, impact, and clinical manifestations of HCMV coinfection in HIV-positive individuals in Port Harcourt. The research aimed to provide valuable insights that can enhance patient care and enhance future studies.

2. Materials and Methods

2.1 Study Area

University of Port Harcourt Teaching Hospital (UPTH) in Port Harcourt, Rivers State, Nigeria, a tertiary health institution providing comprehensive healthcare services, including HIV care and monitoring. Port Harcourt, Rivers State, Nigeria: A metropolitan setting with a high patient load for HIV care, diverse sociodemographic groups, and relevance for regional infectious disease surveillance. OPD and HIV clinics at UPTH, where patients routinely present for ART initiation, CD4 count monitoring, viral load testing, and opportunistic infection screening. UPTH has a large cohort of HIV patients, diagnostic laboratory capacity, and systematic patient records that support seroepidemiological research.

2.2 Study Design

A cross-sectional seroepidemiological design based in a hospital was used for this investigation. Blood samples from HIV-positive patients visiting the University of Port Harcourt Teaching Hospital (UPTH) in Rivers State, Nigeria, were collected and analysed at one particular time. The design was suitable for identifying the seroprevalence of prior Human Cytomegalovirus (HCMV) infection in HIV-positive patients, as determined by the presence of anti-HCMV IgG antibodies. To assess their relationship with HCMV seropositivity, sociodemographic and clinical information (such as age, sex, ART status, and CD4 count) were collected. Without follow-up, this cross-sectional method enabled effective disease burden estimation and risk pattern identification within the study population.

2.3 Study Population

This study was a cross-sectional study consisting of 93 HIV-infected individuals visiting a major health institution in Rivers State. The ethical conduct of the work was approved by the University Teaching Hospital (UPTH). The participants' demographic information was obtained through the administration of standardised questionnaires. The 93 participants included in this study were eligible participants who were 18 years and above, HIV positive and gave their consent. On the other hand, all subjects who were below 18 years were excluded from the study.

2.2 Laboratory analysis

Plasma was analysed for the presence of HCMV IgM at the University of Port Harcourt's Virus & Genomics Research Unit of the Department of Microbiology.

2.2.1. HCMV IgM Serological Analysis

Serum antibodies against HCMV were analysed using a commercial ELISA kit (DIA. PRO) specific for HCMV IgM. The serologic test and result interpretation were in accordance with the manufacturer's instructions. The cut-off values for OD450nm were calculated following the manufacturers protocol (OD of negative control plus 0.250) which was employed as a verge for defining the reactive and non-reactive plasma.

2.3. Data analysis

Microsoft Excel version 2021 (Microsoft, USA) was utilized to evaluate the data. The statistical significance of every analysis was determined where appropriate using the Chi-square test or Fisher's exact test at a 5% significance threshold.

2.4 Ethical consideration

The study was conducted after obtaining ethical clearance from the University of Port Harcourt Research Ethics Committee

3. RESULTS

3.1. Analysis of Study Participants' Socio-demographic Characteristics

The socio-demographic characteristics of the participants of the study are revealed in Table 1. The sample involves a total of 93 participants, of whom 39(41.9%) were males, and 54 (58.1%) were females. With respect to age distribution, 1(1.08%) of the participants were within the age range of <24 years, the majority of the participant 75 (80.6%) were in the participants were of the age range of 25-44 years, 11(11.8%) of the participants were in the age range of 45-54 years, and 6(6.5%) of the participants were > 60 years of age. With regards to marital status, 44 (47.3%) of the participants were reportedly single, 40(43.0%)

of the participants were married, 3 (3.2%) of the participants reported to be divorced, and 6(6.5%) were widowed. The educational background of the participants was as follows: 25 (26.9%) of the participants reported having at least completed primary school, 31 (33.3%) of the participants had attained secondary education, 21 (22.6%) of the participants had attained tertiary education, and 18 (19.4%) of the participants reported having no education. With regards to their employment status, 12 (12.9%) were recorded to be students, 12(12.9%) were recorded to be employed, 18(19.4%) were reportedly unemployed, and 51(54.8%) were self-employed. Furthermore, with regards to religion, an overwhelming number were recorded for Christians, 82(88.2%), 4(4.3%) were recorded for Islam, 5(5.3%) were recorded for traditionalists, 2(2.15%) were recorded for none. Lastly, based on the use of ART, 92(98.9%) were recorded for ART use, and only 1(1.08%) was recorded for no-ART.

Table 1: Socio-demographic characteristics of study population

Variables	Categories	No. Tested N=93 (%)
Age group	<24 years	1(1.08)
	25-44 years	75(80.6)
	45-59 years	11(11.8)
	>60 years	6(6.5)
Gender	Male	39(21.0)
	Female	54(29.0)
Marital status	Single	44(23.7)
	Married	40(21.5)
	Divorced	3(1.6)
	None	6(3.2)
Religion	Christianity	82(44.1)
	Islam	4(2.15)
	Tradition	5(2.7)
	None	2(1.08)
Education	Primary	25(13.4)
	Secondary	31(16.7)
	Tertiary	21(11.3)
	No education	18(9.7)
Occupation	Student	12(6.5)
	Employed	12(6.5)
	Unemployed	18(9.7)
	Self-employed	51(27.4)
ART usage	On ART	92(49.5)
	Not on ART	1(0.5)

3.2. Statistical analysis

The overall risk of HCMV infection among the study population is reported in Table 2. Also, with respect to their statistical analysis, most sociodemographic characteristics did not show statistical significance except the religion (p=.007) and ART use (p=.043).

Table 2: Statistical analysis of study population with respect to HCMV IgM seroprevalence

Variables	Categories	No. Tested (%)	Seropositivity (%)	X^2	P- Value	Significance
Age group	<24 years	1(1.08)	0	2.022	0.568	Not significant
	25-44 years	75(80.6)	2(1.08)			
	45-59 years	11(11.8)	1(0.54)			
	>60 years	6(6.5)	1(0.54)			
Gender	Male	39(21.0)	2(1.07)	0	1	Not significant
	Female	54(29.0)	2(1.07)			
Marital status	Single	44(23.7)	1(0.54)	6.065	0.108	Not significant
	Married	40(21.5)	3(1.61)			
	Divorced	3(1.6)	0			
	None	6(3.2)	0			
Religion	Christianity	82(44.1)	4(2.15)	12.13	0.007	Significant
	Islam	4(2.15)	0			
	Tradition	5(2.7)	0			
	None	2(1.08)	0			
Education	Primary	25(13.4)	1(0.54)	2.022	0.568	Not significant
	Secondary	31(16.7)	0			
	Tertiary	21(11.3)	1(0.54)			
	No education	18(9.7)	2(1.07)			
Occupation	Student	12(6.5)	0	2.022	0.568	Not significant
	Employed	12(6.5)	2(1.07)			
	Unemployed	18(9.7)	1(0.54)			
	Self-employed	51(27.4)	1(0.54)			
				4.088	0.043	Significant
ART usage	On ART	92(49.5)	4(2.15)			
	Not on ART	1(0.5)	0			

4. Discussion

In the context of HIV-positive individuals and the advancement of HIV illness, HCMV represents a significant opportunistic pathogen. There seems to be some evidence linking HCMV seropositivity to overall mortality in the HIV population, according to many studies (Stockdale et al., 2018). Serological markers (IgG and IgM antibodies) against HCMV were used to ascertain the seroprevalence of infection among study participants.

The study recorded a low level of IgM seroprevalence 4(2.15%) among the study population. This agrees with a 2.8% anti-CMV IgM positivity in a study in Guinea Bissau (Grønborg et a., 2018), indicating current infection or reinfection/reactivation of human cytomegalovirus. The study also agrees with other studies reported here in Nigeria and other countries. According to Chilaka et al. (2016), pregnant women in Kebbi State, North West Nigeria, had an anti-CMV IgM prevalence of 1.1%. Various studies found low prevalence levels of 2.3% in the USA and 2.8% in Guinea-Bissau, respectively. Ojide et al. (2012) reported a prevalence of 3.1% in Benin, while Schoenfisch et al. (2011) and Grønborg et al. (2018) found similar prevalence values.

Also, Mhandire et al. (2019) reported a 2.9% prevalence in Zimbabwe while Abubakar and Adamu (2021) recorded a 7.1% IgM. A study conducted in Jos Plateau State found that 4.80% of normal women have IgM antibodies (Akunaeziri et al., 2021). Similarly, this study's observed level of anti-HCMV IgM 1.10% is lower than previous reports of active human cytomegalovirus infections in pregnant women in Kebbi State (Waje et al., 2023).

On the other hand, the present study's prevalence was lower than that of a number of previous investigations. Adeiza et al. (2016) and Kiros et al. (2021) similarly found IgM antibody prevalence of 13.2% and 12.4%, respectively, in comparable research. Fowotade et al. (2015) showed 11.1% anti-HCMV IgM and 57.90% IgM -CMV antibodies among blood donors in Sokoto (Hamid et al., 2014). Also, Results of one study report CMV IgM antibody seroprevalence to be 8.4%-9% among HIV-infected Thai children (Schoenfisch et al., 2011).

In Nigeria, Okonko et al. (2023) reported 20.4% among females in Buguma, Rivers State, Odebisi-Omokanye et al. (2017) reported 24.9% among women in Ilorin, 21.70% was reported among pregnant women in Lokoja, Kogi State by Pennap et al. (2016). Similarly, 10.60% anti-HCMV IgM among HIV infected Children and Adolescents in the Federal Capital Territory (FCT), Abuja, was reported in a study by Akunaeziri et al. (2021).

Additionally, Okonko et al. (2022) reported 25.6% HCMV IgM prevalence in Port Harcourt, Nigeria. These figures were higher than the findings of this present study. The variation in seroprevalence of HCMV IgM observed among these studies may probably be due to epidemiological and methodological differences. It could also be inferred that there has been a decline in prevalence, as earlier studies recorded increased prevalence values.

5. Conclusion

HCMV has evolved many tactics to live with HIV and the human immune system. The high seropositivity of HCMV in this study among HIV-infected individuals reflects the need for proper control of coinfections. Ultimately, the interplay between HIV and CMV underscores the need for vigilant screening, early intervention, and integrated care strategies. This study underscores the significant epidemiological and clinical burden of HIV/HCMV coinfection in the era of widespread ART. The findings confirm that CMV seroprevalence remains markedly higher in people living with HIV (PLWH), with prevalence exceeding 90%. The study further reveals that sociodemographic factors such as sex, occupation, marital status, education, and religion contribute to HCMV seroprevalence among PLWH. These findings reaffirm that HCMV is not merely a background infection but a key cofactor in HIV disease progression and comorbidities, particularly among young adult populations.

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