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(RESEARCH ARTICLE)

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Detection of Epstein-Barr Nuclear Antigen (EBNA) IgM among healthcare workers in some selected hospitals in Rivers State, Nigeria

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Abstract

Several diseases are associated with Epstein-Barr virus (EBV) and they can be life-threatening, especially in immunocompromised individuals. Moreover, there are no well-established EBV prevention and control strategies in Nigeria. Therefore, this study was carried out to assess the prevalence of Epstein-Barr (EBNA) IgM antibody among Public Health Workers in Port-Harcourt, Nigeria. A cross-sectional survey was adopted to randomly analyze 94 public healthcare workers (HCWs) working in a public health centre in Rivers State, Nigeria. Enzyme-Linked Immunosorbent Assay (ELISA) was used to analyze EBNA IgM antibodies in the samples obtained. Chi-Square analysis was used to determine the association of the infection with socio-demographic factors. Overall, 3 patients were seropositive for EBNA IgM, constituting 3.1% of the sample while 91 (97.8%) were observed to be seronegative for EBNA IgM antibody. Reactivity of Epstein–Barr virus did not differ significantly as regards sex distribution, but it was significant with regards to marital status and professional cadre in the health care facility. Sera EBNA IgM positivity was highest in the age group >40 (9.5%) followed by the age group 18-29 (5%), single (4%), married (3.2%), male (9.5%), female (1.3%). This study confirms the presence of Epstein-Barr virus primary infection among public health workers in Port-Harcourt, and an onward risk of infectious mononucleosis. This finding, therefore, alerts us to the establishment of surveillance programs for the detection, treatment and control of EBV in Port-Harcourt and Nigeria at large.

Keywords: Mononucleosis; Antibodies; Formites; Prevalence; Epstein Barr virus (EBV)

1. Introduction

Epstein-Barr virus (EBV) is a notable human pathogen in the herpes virus family (Balfour, 2014) and has been implicated as the etiological agent of acute infectious mononucleosis (a usually self-limiting acute illness characterized by fever, weakness, sore throat, swollen lymph nodes) in young children and immunocompromised individuals (Dunmire et al., 2018). However, mononucleosis is only one of many health problems associated with EBV. This virus causes several forms of cancer, including Burkitt lymphoma, nasopharyngeal carcinoma and Hodgkin lymphoma (Hjalgrim et al., 2007), and is implicated in the pathogenesis of autoimmune diseases such as multiple sclerosis (Moreno et al., 2018). Also, Chen et al. (2021), reported that 55.2% of COVID-19 patients had positive VCA IgM antibodies, indicating a high incidence of EBV coinfection in COVID-19 patients further elaborating the influence of this virus in co-morbidities. In a few circumstances, chronic EBV infections might lead to complications and death in immunosuppressed individuals (Anejo-Okopi et al., 2019) while primary acute EBV infections are largely asymptomatic and the latent infection could persist for a lifetime. EBV infections have been linked to hemophagocytic syndrome, a severe inflammatory illness, characterized by prolonged fever, cytopenia, and liver dysfunction (Chen et al., 2004). However, immunocompromised patients may have difficulty controlling the viral infection and often develop severe

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and life-threatening conditions, such as severe inflammation and malignancies (Zhang et al., 2014). The disease is manifested by enlargement of the lymph nodes and spleen, sore throat, headache, nausea, general weakness and tiredness and a mild fever that peaks in the early evening.

Previous studies have estimated that seroepidemiology in Europe and the United States to be over 50% of adolescents would have been seropositive to EBV (Dowd et al., 2013). However, studies in Africa (Ethiopia and Nigeria) and Asia (Taiwan) have reported seroprevalence from 6% to 11% -17% (Ibrahim et al., 2018; Bishop and Adegoke, 2016). Approximately 95% of the world's population sustains an asymptomatic life-long EBV infection which spreads via contact with infectious body fluids, such as saliva, blood and semen (CDC, 2021a). The virus spreads by saliva through kissing, sharing drinks and food, using the same cups, eating utensils, or toothbrushes and having contact with toys that children have drooled on (CDC, 2021b). Early transmission of EBV in humans occurs through the mouth, but research in developing and developed countries has shown that in young adults and children, the virus can be transmitted through other ways such as infected fingers and saliva-contaminated fomites (Sangueza-Acosta & Sandoval-Romero, 2018).

The virus primarily infects epithelial cells and spreads to B lymphocytes where it persists for life (Dunmire et al., 2015). In immunocompetent hosts, B lymphocytes and epithelial cells are the cellular targets for EBV primary infection. However, EBV can infect a wide range of non-B lymphocytes which determine the development and pathogenesis of EBV-related diseases (Smatti et al., 2017).

The activities of healthcare workers involve continual exposure to factors (especially biological) in the process of performing therapeutic, nursing or diagnostic services (Gorman et al., 2013). The nature of the work of the healthcare givers generates a risk of exposure and/or transmission of harmful biological factors including EBV due to, direct contact with the patient, the patient's specimens and excretions (Prażak & Kowalska, 2017).

A definitive diagnosis of acute EBV infection can be made by testing for specific immunoglobulin M and G (IgM and IgG) antibodies against EBV antigens in the right clinical context. Acute primary EBV infection demonstrates positive EBV VCA IgM and IgG with negative EBNA, while past EBV infection shows positive EBNA and positive EBV VCA IgG with negative EBV VCA IgM (Jhaveri et al., 2022). The sero-epidemiological data would provide useful information for public health interventions towards target populations. This study aimed to estimate the rate of active EBV infection amongst public healthcare workers.

2. Material and methods

2.1. Study Design

This is a cross-sectional study that was carried out amongst public health care workers attending community public health centres in Port-Harcourt, Rivers state, Nigeria.

2.2. Sample/Data Collection and Ethical Consideration

Consent was obtained from participants after carefully explaining the concept of the study to them. Detailed information on socio-demographics (including age, gender, marital status, and category of service provided) associated with EBV acquisition was obtained using a structured questionnaire. A specimen of 5ml venous blood was aseptically drawn from the enrolled subjects into sterile EDTA tubes. The blood was allowed to separate and the plasma aspirated into sterile Eppendorf tubes.

2.3. Serological analysis

Laboratory analysis was carried out at the Virus & Genomics Research Unit, Department of Microbiology, University of Port Harcourt, Choba, Rivers State. The samples were analyzed for EBV-specific IgM antibodies (qualitative assay of IgM antibodies) by using the commercially available ELISA kit manufactured by DiaPro Diagnostic Bioprobes Srl (Milan) according to the manufacturer's instructions. Washing was done automatically using an ELISA washer (ELx50, Biotek, USA). Plates were read using an ELISA plate reader (ELx808i, Biotek, USA) at an absorbance of 450 and 630 nm (Okonko & Egbogon, 2022). Test results were interpreted as a ratio of the sample OD450nm and the Cut-Off value (or S/Co) following the manufacturer's instructions.

2.4. Data analysis

The chi-square test was used to test associations between demographic and behavioural risk factors and the EBV serostatus of study participants. P ≤0.05 was considered statistically significant.

3. Results

As shown in Table 1, a higher seroprevalence of EBNA IgM antibody of 3.2% was observed for married men and 4.0% for singles. Statistically, marital status was significantly associated with the prevalence of IgM antibodies against EBNA. Higher seroprevalence of 100.0% EBNA IgM antibody occurred in administrative staff (5.2%), Laboratory Scientists (8.3%) and Pharmacists (11.1%) as shown in Table 1. Of the 94 specimens tested, (9.5%) of the 21 males were with EBNA IgM antibody, while (1.3%) of the 73 females were with EBV IgM antibody. With age, only two groups out of the three groups were reactive, 9.5% in the age group >40 was found to be seropositive and 5.0% from the age group 18-29. The other age group 30-39, showed no presence of EBNA IgM antibody (Table 1).

Table 1 Seropositivity of EBNA IgM antibody amongst the Study Population

Socio-Demographic Characteristics	Categories	No. Tested (%)	No. Positive for EBV IgM (%)	P-value
Age	18-29	20 (21.2)	1(5.0)	0.09
	30-39	53 (56.3)	0(0.0)	
	>40	21 (22.5)	2(9.5)	
Gender	Females	73 (77.7)	1(1.3)	0.06
	Males	21 (22.3)	2(9.5)	
Marital Status	Married	61 (64.8)	2(3.2)	0.85
	Singles	25 (26.5)	1(4.0)	
	Widowed	8 (8.4)	0(0.0)	
Profession	Medical Doctors	11 (11.7)	0(0.0)	
	Nurses	18 (19.1)	0(0.0)	
	Admin. Staff	19 (20.2)	1(5.2)	
	Security staff	2 (2.1)	0(0.0)	0.86
	Lab. Scientists	13 (13.8)	1(7.6)	
	Physiotherapists	3 (3.1)	0(0.0)	
	Theatre Attendants	2 (2.1)	0(0.0)	
	Cleaning staff	15 (15.9)	0(0.0)	
	Students	2 (2.1)	0(0.0)	
	Pharmacists	9 (9.5)	1(11.1)	
Total		94	3(3.1)	

4. Discussion

The appearance of EBNA IgM in HIV-positive individuals indicates the presence of the virus and is suggestive of acute infection (Anejo-Okopi et al., 2019). The result of this study revealed an Epstein-Barr virus seroprevalence rate of 3.1% among public health workers in Port Harcourt. This compared with the prevalence of 3.2%, 4.0% and 6.6% reported in a similar study in Port Harcourt, Ogbomosho and Zaria, respectively (Cookey et al., 2023; Kolawole et al., 2017; Bishop & Adegoke, 2016) but much lower than the prevalence of 20.0% reported in Ghana (Adjei et al., 2008) and 56.1% in India (Patel et al., 2021). The 3.1% reported here is higher than the prevalence of 1.1% observed in Calabar, Nigeria

(Okonko et al., 2023). The fluctuations in seroprevalence rates may be a result of differences in geographic locations or differing ELISA kits used for laboratory tests.

The result of this study implies that 3.1% of the participants had recent contact with the virus since EBNA-IgM is used as an indicator of recent primary EBV infection and is secreted transitionally (Patel et al., 2021). The detection of EBNA-specific IgM in a lower percentage of cases is not unusual as they are the first set of antibodies produced in an active infection. However, a remarkably lower (1.8%) prevalence was observed by Smatti et al. (2017) in a similar study. The fact that the virus is easily transferable from one person to another by mere contact with body fluids, could cause an increase in the prevalence of the circulating antibodies.

Considering the sex distribution prevalence, the highest prevalence of EBNA IgM antibody in this study was found among the males (9.5%) than in the females (1.3%) contradicting earlier reports of Kolawole et al. (2016), Schaftenaar et al. (2014), Anejo-okpi et al. (2019) and Okonko et al. (2023) where the prevalence was dominant in the female population. However other studies by Adjei et al. (2008), Chakraborty et al. (2010) and Cookey et al. (2023) corroborate with the findings of this study where the prevalence was dominant in the male population.

Reactivity to EBNA IgM antibody did not differ significantly in the age distribution. The highest incidence of anti-EBNA IgM (5.8%) was in the age range (41-50) years. This indicated that EBV antibody prevalence increases with age which is following Schaftenaar et al. (2014). Also, Okonko et al. (2020) observed the highest seropositivity for IgM antibodies in the age group 31–40 years.

Reactivity to EBNA IgM antibody did not differ significantly in the marital status distribution. The highest incidence of anti-EBNA IgM (4.0%) was among singles. Also, Cookey et al. (2023) and Okonko et al. (2023) observed the highest seropositivity for IgM antibodies in singles.

Reactivity to EBNA IgM antibody did not differ significantly in the profession distribution. The highest incidence of anti-EBNA IgM (11.1%) was among the Pharmacists. This was followed by Laboratory Scientists (7.6%) and administrative staff (5.2%). All other categories of healthcare workers did not have any EBNA IgM antibodies. Also, Cookey et al. (2023) and Okonko et al. (2023) observed the highest seropositivity for IgM antibodies among students in Port Harcourt, Nigeria.

5. Conclusion

Effective disease outbreak response has been a challenging accomplishment for the Nigerian health system due to an array of hurdles. This study confirms the presence of Epstein Barr virus primary infection among public health workers in Port Harcourt, and an onward risk of Infectious mononucleosis. This comes with the responsibility of establishing surveillance programs for the detection, treatment and control of EBV in Port Harcourt and Nigeria at large. Healthcare facilities must take the necessary measures to prevent the spread of the virus. EBV is a major threat, especially to children of early years and immunocompromised adults, strategies must be enacted to prevent, and control transmission as these categories of people visit health facilities very often.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

Statement of ethical approval

All authors declare that all experiments have been examined and approved by the University of Port Harcourt Research Ethics Committee. Therefore, the study is performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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