



Seroprevalence of Cytomegalovirus among Paediatric Patients with Seizures Attending Federal Neuropsychiatric Hospital, Kaduna, North West Nigeria

Edward I. Usman^{a*}, Warty J. Reuben^a, Musa A. Maikano^b, Edward, D Shetu^c and Samuel P. Kelechi^a

^a Department of Microbiology, Faculty of Science, Kaduna State University, Nigeria.

^b Federal Neuropsychiatric Hospital Barnawa Medical Laboratory Services, Kaduna State, Nigeria.

^c Tehilah Medical Laboratory Sabon Tasha Chukun LGA Kaduna State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author Authors EIU and WJR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MAM and EDS managed the analyses of the study. Author SPK managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPR/2022/v11i3213

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/66841>

Original Research Article

Received 10/03/2021

Accepted 17/05/2021

Published 30/12/2022

ABSTRACT

Introduction: Cytomegalovirus causes a congenital infection, which poses a great public Health challenge such as hearing loss, seizure and mental disorder among children.

Methodology: Enzyme Linked Immunosorbent Assay (ELISA) was used to screen serum samples (90) collected from Patients presented with Seizure between the ages 0-13 years for Cytomegalovirus IgG specific antibodies.

*Corresponding author: Email: Ishidi03@yahoo.com;

Results: The presence of CMV IgG specific antibody among Seizure patients obtained from this study recorded a prevalence of 68(75.5%). The age groups 9-13 years presented highest CMV (IgG) specific antibodies response 36(40.0%), followed by ages 5-8 years 22(24.4%) and least for ages 0-4 years 10 (11.1%), $P>0.005$. The CMV (IgG) specific antibodies response with respect to gender presented male with highest prevalence 50 (55.5%) than their female 18 (20.0%) counterparts $P<0.005$.

Conclusion: Therefore CMV is highly prevalent within the study area and the need for necessary facilities to be available in screening pregnant women of the virus in order to prevent the spread vertically to their fetuses thereby increases the risk of Seizure.

Keywords: Cytomegalovirus; Seizure; IgG; ELISA.

1. INTRODUCTION

Cytomegalovirus (CMV) is a member of the Herpes family with double stranded DNA that measure approximately 200nm [1,2]. The virus is responsible for a wide range of infections in human of all ages [3]. CMV causes enlargement of cells in the body, hence the prefix Cytomegalo [4]. Infection with CMV is asymptomatic at all ages, unlike in foetus and neonates that could lead to neurological complications and death [5].

The Virus could remain latent in the body. However, severe recurrent infection may occur in immunocompromised patients [6,7]. Separate studies by other researchers have proved that Cytomegalovirus causes congenital infection and brain damage which could lead to defects in babies of infected mothers [8,9,10].

The Virus can be transmitted through close contact with body fluids of an infected person[11,12,13]. This infection poses important public health problem because of its frequency in severe congenital anomalies such as microcephaly, intrauterine, growth retardation, mental retardation, inguinal hernia in male, seizure, loss in hearing and neuromuscular abnormalities [14,15].

Congenital CMV infection has been reported in various countries, 15-20% of sensorineural hearing loss and 7% of Cerebral palsy in United Kingdom, and rates of 0.15-2.2% of live birth from United States of America [2,16,17]. On the same hand, sero-prevalence rate of CMV IgG antibodies among pregnant women In Singapore, Thailand, Iran, Turkey and Spain have also been reported as; 87%, 100%, 93%, 98.5% and 84% respectively [18,19,20,21].

In Nigeria, Cytomegalovirus infection was also reported as 45% and 33% in breast milk, 86.15% (IgG) among expected mothers, 77.1% (IgG)

among primigravid women in Bida, 97.2 % (IgG) among pregnant women in Lagos, 80.5%(IgG) among children hearing impairment and 10.5%(IgM) among pregnant women in Kafanchan Kaduna State [22,23,24,25,26].

Cytomegalovirus Congenital seizures disorder account for 10% of babies born with symptomatic infection and it is a very common abnormality associated with the infections. It is usually associated with children severely affected by systematic CMV infections of the nervous system. A seizure may occur at birth or within six months of life with varying severity [8]. The aim of this study therefore is to determine the seroprevalence rate of cytomegalovirus among pediatric patients presenting with seizure at Federal Neuropsychiatric Hospital, Barnawa, Kaduna State.

2. METHODOLOGY

2.1 Study Design/Area

The study was a cross sectional study carried out at Federal Neuropsychiatric Hospital Kaduna a Tertiary Mental Health Hospital with 200 beds capacity. It is an institution for training Mental Health Professionals. Patients who were diagnosed clinically of seizure from ages 0-13 years at the Child and Adolescent unit were used for this research.

2.2 Sample Size

The sample size was calculated using the descriptive studies formula [27]

$$n = \frac{z^2 pq}{d^2}$$

Where the P = Value of proportion of interest (If no information is known about p then $p= 0.5$)
d= Tolerance eg within 0.05

Hence: $n = \frac{1.96^2 \times 10/100 (1-10)}{0.05^2} = 136$ samples.

2.3 Inclusion Criteria

The study included paediatric patients clinically diagnosed with seizure within ages 0-13 years whose patient/guardian consented for the investigation.

2.4 Exclusion Criteria

The study excluded patients outside the ages 0-13 years whose parent/guardian did not consent to the investigation.

2.5 Sample Collection

Two milliliters of blood were collected via the ante cubital vein using sterile vacutainer into a sterile plain tube and labelled appropriately. The blood was centrifuged at 3000rpm for 5minutes. The sera was harvested into clean cryo-vials and stored at -20°C until it is required for use. A total of 90 samples were collected during three months of this research.

2.6 Detection of IgG Antibodies Using Enzyme Linked Immunosorbent Assay (ELISA)

Samples were analyzed for the presence of IgG antibodies using the Enzyme Linked Immunosorbent Assay (ELISA) method according to the kit's manufacturer's instruction made by ASIA –LION Biotechnology Company China. Samples were incubated with mouse monoclonal antibody against human IgG bound to the solid surface for a microtitre well. Patient IgG is captured by the surface bound antibody. Unbound serum component are washed away, patient antiCMV IgG antibodies are detected and bound by an immunocomplex enzyme conjugate, consisting of CMV antigen which is conjugated to horse radish peroxidase. Unbound conjugate is removed by aspiration and washing. Substrate is then added and incubated in the presence of bound enzyme the substrate is converted to end product. The absorbance of this end product is read spectrophotometrically at 450 nm and is directly proportional to the concentration of IgM antibodies to CMV antigen present in the sample [25].

3. RESULTS

A total of 90 samples were collected from Patients presenting with Seizure between the ages 0-13 years and screened for

Cytomegalovirus IgG specific antibodies. The presence of CMV IgG among seizure patients obtained from this study was presented as prevalence of 68(75.5%).

Table 1 however present the seroprevalence of CMV IgG in relation to the age groups of the patients. CMV seroprevalence IgG specific antibody was highest in ages 9 - 13 years 36(40.0%) and least in ages 0 -4 years 10(11.1%).While ages 5-8 years has 22(24.4%) prevalence. The value however is statistically significant with $\chi^2 = 0.024$, $df = 2$ $P > 0.05$ $CL = 95\%$.

Table 2 shows relationship between IgG antibodies with the genders. The Males presented prevalence of 50(55.5)% IgG specific antibodies response while the females presented 18(20.0%). However, there was no statistical significant difference between the seroprevalence IgG specific antibody responses in relation to gender from this study with $\chi^2 = 27.7$, $df = 1$, $CL = 95\%$, $P < 0.05$.

Fig. 1 is a pie-chart showing the frequency distribution of patient parent/guardian occupation. The data shows that 41% are civil servant, 32% businessmen, and 17% are farmers.

Fig. 2 is a pie-chart showing the frequency distribution of patients area of residence. The chart reveals 57% living in Urban settlement, 14% semi-urban and 19% in rural area.

Fig. 3 is a pie-chart demonstrating the patients educational status. The chart shows that 54% are in school, 8% have been withdrawn from school while 28% were not in school.

4. DISCUSSION

Cytomegalovirus infection is commonly spread in developing and low social economic countries. CMV infection was also earlier reported to be the viral cause of birth defects in industrialized countries [28]. This study however has recorded a prevalence of 75.5% of CMV (IgG) in patients presented with seizure.

In other separate previous studies, it revealed 80% prevalence of CMV infection in children who attend daycares, particularly children younger than 2 years was reported [25,29,30,31].

The 75.5% prevalence obtained in this study however is similar to the work of Redwan, *et al.*,

[29] who also reported prevalence of 80.7%. Similarly a separate study, Adisa, et al., [30] reported higher prevalence of 98.9% IgG specific antibodies to CMV in samples of 94 mothers while their corresponding newborns had 86.2% sero prevalence rate. More so, Yeroh et al.[32] recorded 94.8% of CMV IgG among pregnant women in Kaduna state. Although infection of the mother during pregnancy could be without consequence, however, there may be a serious effect on the fetus [2]. Other reports from other countries was also documented; In Singapore, Thailand, Iran, Turkey and Spain the seroprevalence rate of CMV IgG antibodies among pregnant women was reported as; 87%, 100%, 93%, 98.5%, and 84% respectively [18,19,20,21].

In Nigeria, a study conducted in 2008, reported a prevalence of 45.0% and 33% IgM antibodies among breastfeeding mothers and their infants [22]. Similarly, Okwori et al.[23] in a study among expectant mothers in Bida, Nigeria, reported IgG antibody prevalence of 86.1% among multigravid

women and 77.1% among primigravid women. Therefore, there is justification on high rate CMV in Children since it can be transmitted from mother to child.

From this study it was revealed that ages 9-13yrs had the highest prevalence 68(40%), followed by ages 5-8yrs 22(24.4%) and least for ages 0-4yrs 10(11.1%). This trend had earlier been explained by Redwan, et al.,[29] who explained that CMV Sero prevalence increases gradually with age. This findings however shows statistically significant with $P > 0.05$.

In this studies males 50(55.5%) have a higher frequency than female 18(20.0%) as shown in Table 2. This is not in agreement with the work of Redwan, et al.,[29], where females have a 86.8 % and males 75%. This shows a gradual increase in the prevalence between female and male. However, there is no statistical significant difference between the two genders towards contracting the infection with $P < 0.05$.

Table 1. Prevalence of CMV (IgG) among patients in relation to age group

Age (years)	Samples Screened	Sex		CMV (IgG)	CMV (IgG)
		Males	Female	Positive	Negative
0 – 4	16	16	0	10(11.1%)	6(6.6%)
5 – 8	32	24	8	22(24.4%)	10(11.1%)
9 – 13	42	30	12	36(40%)	6(6.6%)
Total	90	70	20	68(75.5%)	22(24.4%)

$X^2 = 0.024$ $df = 2$ $p > 0.05$ $CL = 95\%$

Table 2. Prevalence of CMV (IgG) in relation to gender

Gender	Samples Screened	CMV (Positive)	CMV(Neg)
Male	70	50(55.5%)	20(22.2%)
Females	20	18(20.0%)	02(2.2%)
Total	90	68(75.5%)	22(24.4%)

$X^2 = 27.7$ $df = 1$ $P < 0.05$ $CL = 95\%$

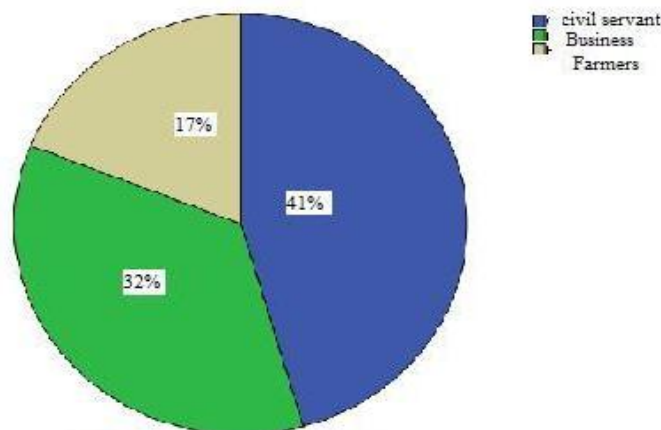


Fig. 1. CMV (IgG) Positive Parents/Guardian Occupation

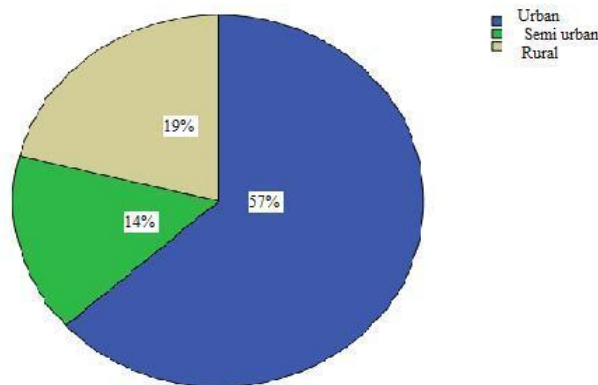


Fig. 2. Frequency distribution of CMV (IgG) Positive patients with respect to residence

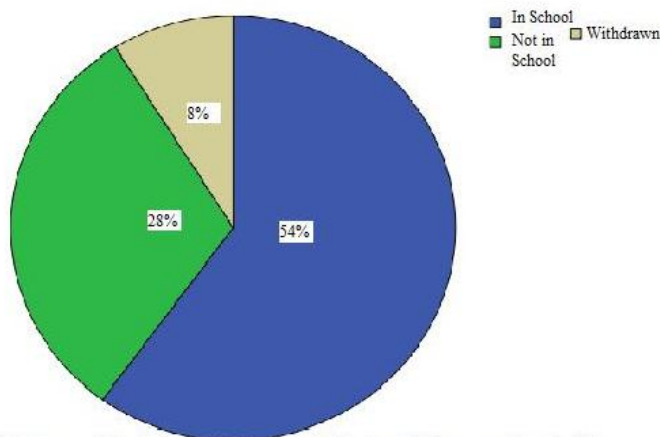


Fig. 3. Frequency distribution of CMV (IgG) Positive patients with respect to educational status

This study further reveals, that 41% of the parent/guardian of CMV positive (IgG) patients were civil servants, while 32% were businessmen and 17% farmers. This trend with high value from civil servants was explained earlier by other authors that civil servants and business class keep their children to a daycare during their working hours and this could predispose the children to the virus since most of the care givers are either secondary school level graduate or not even knowledgeable of the virus since is not common like the HIV [25,30,31].

The study further reveals that 54% of the patients are in school, 18% were withdrawn from school by parent and 28% are not in school. This suggests that Seizures have a greater negative effect on children, especially on their educational and social status. Some parent will prefer their children at home due to the stigmatization and trauma associated with seizures in any episode that occur to the patient. Seizure is attributed to

believes by most Africans that is associated with Evil spirit, and most times such patients are taken to prayer houses or native doctors especially those in the rural area before resolving to the orthodox.

5. CONCLUSION

Cytomegalovirus is highly associated with Seizure, therefore the need for public awareness with the purpose of educating the populace on CMV and its public health challenge associated with it, in order to eradicate stigmatization in relation to the patient's condition, traumatization that comes with seizure and its social economic challenge. There is a need for training for community and primary Health care workers so that they can be involve in managing of such patients. The need of awareness to day care and crèche worker and pregnant women on how to prevent the spread of the disease through hygienic way of live.

6. RECOMMENDATION

Based on our findings from this study it is recommended that:

- Aggressive awareness is highly needed to the populace on the consequences of the infection.
- Routine screening of sexually active women is needed to avoid transmission from mother to foetus of the infection
- Hand wash should encourage especially after changing diapers
- Personal hygiene should encourage especially to those handling children and pregnant women.
- There is a need to develop Vaccine or any prophylaxis against CMV infection

CONSENT AND ETHICAL APPROVAL

An ethical approval was obtained from Federal Neuropsychiatric Hospital Kaduna ethical committee before embarking on the work. Also consent form was designed and issued to the patients to seek their parent /guardian approval. A questionnaire was designed to collect demographic data of the entire patients.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Boppana SB, Rivera LB, Fowler KB, Mach M, Britt WJ. Intrauterine transmission of cytomegalovirus to infants of women with preconceptual immunity. *New England Journal of Medicine*. 2001;333:1366–1371(s).
2. Nathalie JS, Richard WE. Statement in: Diagnostic procedures for viral, Rickettsia

- and Chlamydial infections 6th Edition. 2005;321–329.
3. Suzuki Y, Taribe Y, Mogami Y, Yanagihara K, Nishikawa M. Epilepsy in patients with congenital Cytomegalovirus infection. *Journal of Brain Dev*. 2008;30(6):420-4. DOI:1010161 j. braindev
4. Prescott ML, Harley JP, Klein DA. *Microbiology*. 6th edition. 2005;862.
5. Griffiths PD, Walter S. Cytomegalovirus. *Current opinion in infectious Disease*. 2005;18(3):242-245.
6. Timbury CM. *Herpes Disease: Notes on Medical Virology* 8th edition.1986;88- 89.
7. Bello C, Whittle H. Cytomegalovirus infection in Gambian Mothers and their Babies. *Journal of Clinical Pathology*. 1991;44:366-369
8. Spring 1998: cytomegalovirus Registry; Available:www.bcm.tmc.edu/pedi/infect/cm v
9. Fowler KB, Pass RF. Risk factors for congenital cytomegalovirus infection in the offspring of young women: Exposure to young children and recent onset of sexual activity. *Paediatric*. 2006;118: 286-292.
10. Dworsky ME, Welch K, Cassady G, Stagno S. Occupational risk for primary cytomegalovirus infection among paediatric health-care workers. *New England Journal of Medicine*. 1983;309 (16):950–953.
11. Gabrielli L, Lazzaroho T, Foschini MP, Lanari M, Guerra B, Eusebi V, *et al*. Horizontal in utero acquisition of cytomegalovirus infection in a twin pregnancy. *Journal of clinical microbiology*: 2003;14(3):1329 –1331(s).
12. Stagno S, Pass RF, Cloud G, Brith WJ, Henderson RF, Walton PO, *et al*. Primary Cytomegalovirus infection in pregnancy incidence, transmission of foetus and clinical outcome. *Journal of the American Medical Association*. 1986;256:1904-1908.
13. HO M. Epidemiology of Cytomegalovirus infection. *Reviews of Infectious Diseases*. 1990;12(7):5701-5710.
14. Jawetz M, Adelberg. *Text Book Medical Microbiology* 24th Edition. 2007;441–445.
15. Morton CC, Nance WE. New-born hearing screening-a silent revolution. *New England Journal of Medicine*. 2006;354:2151-2164.
16. Negro G. Passive immunization during pregnancy for congenital Cytomegalovirus infection. *New England Journal of Medicine*. 2005;353(13):1350-1362.

17. Grosse SD, Dollard SC, Ross DS. Congenital cytomegalovirus (CMV) infections a cause of permanent bilateral hearing loss: A quantitative assessment. *Journal of Clinical Virology*. Epub ahead of print; 2008.
18. Wang A, Tank H, Tee CS. Seroprevalence of cytomegalovirus, toxoplasmosis, and parvovirus in pregnancy. *Singapore Med J*. 2000;41(4):151–155.
19. Arabpou M, Kariyane K, Jankhah A. Human cytomegalovirus in women of child bearing age throughout Fars province-Iran: A population based cohort study. *Malaysian Journal of Microbiology*. 2007; 3(2):23–28.
20. Ali S, Askin G, Hakan O. CMV seroconversion in pregnancy and the incidence of congenital CMV infection. *Turk J Peadiatr*. 2007;49:30–36.
21. Estripeant D, Moreno Y, Ahumada R. Seroprevalence of Cytomegalovirus infection in peuperal women and its impact on their newborns. *Ann Pediatr*. 2007;66: 135–139.
22. Kassim OO, Afolabi O, Ako-Nai KA, Torimiro SEA, Littleton GK, Oke OO. Et al., Cytomegalovirus antibodies in breast milk and sera of mother- infant pairs. *J Trop Pediatr*. 1987; 33(2):75-77.
23. Okwori A, Olabode A, Emmuwen E, Lugos M, Okpe E, Okopi J. et al. Sero-Epidemiological Survey of human cytomegalovirus infection among expectant mothers in Bida Nigeria. *The Internet Journal of infectious Diseases*. 2008;6(2).
24. Akinsegun AA, Kabiru AR, Adeniyi AA, Kikelomo OW. Sero prevalence of Cytomegalovirus antibodies amongst normal pregnant women in Nigeria. *Int. J Women Health*. 2011;3:423-428.
25. Edward DS, Edward IU, Nwankiti O, Shallangwa IB, Abdullahi MM. The Sero-Prevalence of Cytomegalovirus (IgM) Antibodies among Pregnant Women Attending Ante-natal Clinic at the General Hospital Kafanchan, Kaduna State Nigeria. *British Microbiology Research Journal*. 2015;9(5):1-6. Article no. BMRJ. 16863 ISSN: 2231-0886. DOI: 10.9734/BMRJ/2015/16863
26. Edward IU, Elayo S, Ogboi JS, Musa AM, Edward DS, Shallangwa BI, Meshubi F1, Isaac A. Seroprevalence of Cytomegalovirus Among Paediatric Patients with Hearing Loss Attending National Ear Care Centre Kaduna Northwest Nigeria. *Pathology and Laboratory Medicine*. 2017;1(2): 48-53. Available: <http://www.sciencepublishinggroup.com/j/plm> DOI: 10.11648/j.plm.20170102.14
27. Daryl S. Paulson. *Biostatistic and Microbiology A Survival Manual*. 2008 ;4:73-81. ISBN: 978-0-387-77281 DOI: 10.1007/978-0-387-77282-60
28. Staras SA, Dollard SC, Rayford KW, Flanders WD, Pass RF, Cannon MJ. Seroprevalence of Cytomegalovirus infection in the United State (1988-1994). *Clinical Infectious Diseases*. 2006;43(9): 1143- 1151.
29. Redwan AN, Ahmed MM, AlAwfi MS. Prevalence Study of Cytomegalovirus infection among foreign man power in Jeddah Saudi Arabia. *African Journal of Microbiology Research*. 2011;5(17) pp 2539-2549.
30. Adisa T, Bukbuk D, Harry T. Maternofoetal transfer of Cytomegalovirus IgG antibodies in Maiduguri, North Eastern Nigeria. *The Internet Journal of Microbiology*. 2010; 9(1). DOI: 10.5580/c53
31. Brooks GF, Butel JS, Morse SA. *Herpes Viruses In: Jawetz, Melnick and Adelberg's (Ed) medical microbiology*. 24th Edition, McGraw-Hill. New York. 2007;441-445.
32. Yeroh M, Aminu M, Musa BO. Seroprevalence of Cytomegalovirus infection among pregnant women in Kaduna Nigeria. *African Journal of Clinical and Experimental Microbiology*. 2014; 16(1):37-44.

© 2022 Usman et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/66841>