British Microbiology Research Journal
8(1): 343-347, 2015, Article no.BMRJ.2015.126
ISSN: 2231-0886

SCIENCEDOMAIN *international*
www.sciencedomain.org

Prevalence of Dengue Virus and Malaria in Patients with Febrile Complaints in Kaduna Metropolis, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author MOI designed and carried out the research. Authors SAA and VJU Supervised, read, corrected the manuscript and ensured that the research was carried out according to laid down scientific procedures. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BMRJ/2015/15588
Editor(s):
(1) Preeti Bharaj, Department of Microbiology and Immunology, University of Texas Medical Branch (UTMB), Galveston, USA.
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Reviewers:
(1) Francis W. Hombhanje, Centre for Health Research and Diagnostics, Divine Word University, Papua New Guinea.
(2) Anonymous, India.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=1087&id=8&aid=8772

Original Research Article

Received 6th December 2014
Accepted 17th March 2015
Published 10th April 2015

ABSTRACT

Aim: To determine the prevalence of dengue virus and malaria parasites in febrile patients in Kaduna Metropolis, Nigeria.
Study Design: Cross sectional.
Place and Duration of Study: Department of Microbiology, Ahmadu Bello University, Zaria, Kaduna State, Nigeria, during February to August of 2013.
Methodology: Blood specimens were collected from 340 consenting subjects with febrile complaints attending four hospitals in Kaduna Metropolis, Nigeria. Serological determination of dengue virus IgM was carried out using the enzyme linked immunosorbent assay. Malaria status was determined using microscopy technique. Structured questionnaire was administered to determine if the subject was on anti-malaria drug at the time of the research.
Results: A total of 6 subjects were sero-positive for dengue virus IgM giving a prevalence of 1.8%.

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Microscopy gave a prevalence of 46.5% for malaria. There was no statistically significant difference in the occurrence of dengue virus IgM between the subjects on anti-malaria chemotherapy and those without the therapy. About 1.3% of the malaria positive cases were also sero-positive for dengue virus IgM.
Conclusion: The occurrence of dengue virus in the studied population has been evidenced and malaria is still endemic in the studied population.

Keywords: Dengue; malaria; febrile; Kaduna.

1. INTRODUCTION

The dengue viruses are single stranded, positive sense RNA viruses which belong to the genus Flavivirus of family Flaviviridae [1,2]. It is a mosquito-borne pathogen and the clinical outcomes of Dengue virus infection could vary from asymptomatic infection or mild febrile dengue fever (DF) to severe and life threatening dengue haemorrhagic fever (DHF)/dengue shock syndrome (DSS) [3]. Typically, people infected with dengue virus are asymptomatic (80%) or only have mild symptoms such as an uncomplicated fever [4,5]. Others have more severe illness (5%), and in a small proportion it is life-threatening [5,6].

Malaria is also a mosquito-borne infectious disease of humans and other animals caused by protozoans of the genus *Plasmodium*. The World Health Organization has estimated that in 2010, there were 216 million documented cases of malaria. Around 655,000 people died from this disease, many of whom were children under the age of five. The actual number of deaths may be significantly higher, as precise statistics are unavailable in many rural areas, and many cases are undocumented. *Plasmodium falciparum* — responsible for the most severe form of malaria — causes the vast majority of deaths associated with the disease. Malaria is commonly associated with poverty and is a major hindrance to economic development [7].

As the common arthropod-borne diseases with febrile symptom in humans, Dengue fever and malaria represent major public health problems [8]. The early symptoms of dengue fever (High grade fever, headache, fatigue, malaise, nausea, vomiting) mimic that of malaria which is hyper endemic in the environment, thereby making the diagnosis of this viral infection very confusing. In such situations, these infections are quite often misdiagnosed and so, inappropriately treated. Consequently these cases often result in high rate of morbidity, complications and mortality [9]. Therefore, this research is aimed at determining the prevalence of dengue virus and malaria parasites in the studied population.

2. MATERIALS AND METHODS

2.1 Study Design

The study is a cross sectional design cutting across dry and rainy seasons. Data was collected from consenting individuals attending the hospitals during the period of the research.

2.2 Study Area and the Population

Kaduna State occupies part of the Central position of the Northern part of Nigeria (with Kaduna as its capital) and shares boundaries with Niger State to the west, Zamfara, Katsina and Kano states to the north, Bauchi and Plateau states to the east and FCT Abuja and Nasarawa State to the south. Kaduna State lies at latitude 10º20′ north and longitude 7º45′ east. The State occupies an area of approximately 48,473.2 square kilometres and has a population of more than 6 million people [10]. Four hospitals were selected from Kaduna metropolis for sampling in the study.

Inclusion criteria of the patients in the studied population were patients with febrile complaints (temperature >37.5ºC) visiting the hospitals in the period of the research and they were sent to the hospitals laboratories for malaria test. All the sampled patients gave their consent to be involved in the research.

2.3 Blood Sampling Procedures

About 5ml of blood was collected by venipuncture from each of the febrile patients. The blood was allowed to clot at room temperature and the serum was carefully collected after centrifugation at 2,000 rpm for 10 minutes and stored at –4ºC for further analysis. The sample size was determined using the equation $n=[Z^2p(1-p)]/d^2$ as described by Naing et

al. [11] and the prevalence was estimated by Dawurung et al. [12].

2.4 Detection of IgM Antibodies against Dengue Virus

An IgM capture ELISA (MAC– ELISA) as previously described by Vorndam and Kuno [13] was used for the detection of IgM antibodies against DENs, using the Dengue Virus IgM ELISA kit (Diagnostic Automation, Inc., 2391 Craftsman Road, Suite D/E/F, Calabasas, California, USA).

2.5 Determination of Malaria Parasites

This was done by microscopic examination of blood films stained with Giemsa stain [14].

2.6 Data Analysis

Data generated from the research were analysed using SPSS version 19 from SPSS Inc., USA. Chi square analysis was used to check the level of significance in the occurrence of dengue virus IgM and malaria parasite in relation to different variables at 95% confidence level.

2.7 Ethical Clearance

Ethical approval and consent was sought and obtained from the ethical committee of Kaduna State Ministry of Health and the ethical committees of the various hospitals included in the study.

3. RESULTS AND DISCUSSION

3.1 Prevalence of Dengue Virus and Malaria Parasites

A total of 340 serum samples (85 from each hospital) were collected from febrile patients attending these hospitals. Out of the 340 samples studied, 6 (prevalence 1.8%) patients were sero-positive for dengue virus IgM and 2 of the 6 (1.3% of 158 positive malaria cases) were co-infected with malaria and dengue virus (Table 1).

The prevalence of malaria as obtained from the present study is 46.5% (158) using the microscopic technique as presented in Fig. 1.

A sero-prevalence of 1.8% for dengue virus IgM was obtained from the study. Although the prevalence of dengue virus IgM obtained in this study is quite low, it has brought to lime light the occurrence of the virus within Kaduna metropolis, Nigeria. A positive case of dengue virus in a community is of epidemiologic importance as mosquitoes can transmit the virus from an infected person to a high proportion of susceptible individuals within the same environment. This is in line with previous studies by Dawurung et al. [12] with a prevalence of 2.2% and Baba et al. [9] with dengue IgM prevalence of 0.67%.

Out of the 158 positive malaria cases, 2 (1.3%) were sero-positive for dengue virus IgM. This result is very important because Nigeria is one of the few African countries that limit investigation of febrile illnesses to malaria and perhaps typhoid with complete neglect to viral infections. Generally, viral infections suppress the natural immunity of the host and this often allows opportunistic infections to set in [12]. Therefore, a co-infection of dengue and malaria as observed in this study could be very devastating to the host.

The prevalence of malaria obtained in this study using microscopy method is 46.5%. This prevalence is higher than that obtained by Anumudu et al. [15] and Abdulahi et al. [16] with prevalence of 17% and 27%, respectively. This is because the population employed in this study were suspected of malaria and sent to the laboratory to carry out confirmatory malaria tests. Furthermore, this study was conducted just before the onset of rains till into the rainy season, which has been marked as a period of high transmission of malaria [17]. High rainfall and humidity increases mosquito longevity and give room to the collection of clear, still, sun exposed waters, all of which enhance malaria transmission, serving as good vector breeding sites [18].

3.2 Occurrence of Dengue IgM and Current use of Anti-malaria Drug

The percentage occurrence of dengue virus IgM in patients currently on antimalarial drug is presented in Table 2. A percentage occurrence of 3.7% for dengue virus IgM was obtained in those who are currently on an anti-malaria drug. A percentage occurrence of 0.96% for dengue virus IgM was found in those who are not currently on any anti-malaria drug. The chi square value for the relationship is 3.433 with *P*-value of 0.064. The difference in the percentage

Table 1. Co-infection of dengue virus and malaria in the study population

Malaria status	Dengue IgM			
	Total tested	Number positive	% occurrence	Number negative
Positive	158	2	1.3	156
Negative	182	4	2.2	178
Total	340	6	1.8	334

Table 2. Relationship between occurrence of dengue virus IgM and current use of anti-malaria drug

Current use of anti-malaria drug	Dengue IgM			
	Total tested	Number positive	% occurrence	Number negative
Yes	108	4	3.7	104
No	232	2	0.9	230

χ^2 = 3.433, df = 1,P = 0.064

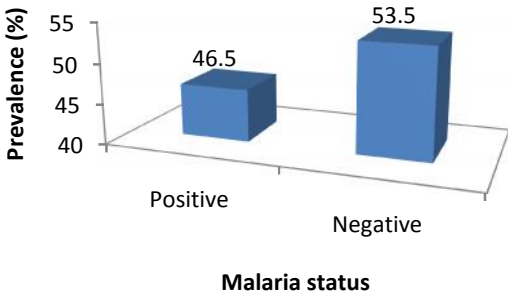

Fig. 1. Prevalence of malaria in the study population

occurrence of dengue virus IgM in relation to current use of anti-malaria drug is not significant, although 3.7% of those that were on anti-malaria drug during the time of the research were sero-positive for dengue virus IgM. This is of immense public health importance as dengue can be misdiagnosed (by under-diagnosis or over-diagnosis) despite available clinical guidelines [19]. Given the lack of specificity of the symptoms of dengue fever, clinicians can confuse dengue with symptoms of other diseases such as influenza, chikungunya, leptospirosis, malaria or typhoid [20]. Misdiagnosis can be influenced by treatment guidelines, for example, although guideline for the treatment of febrile children aged 2 months to 5 years are useful to ensure that children with fever and no alternative explanation are empirically treated for malaria. This guideline may contribute to the misdiagnosis of dengue, particularly in area of low malaria transmission or where physicians are not routinely using malaria smears to confirm diagnosis [19].

4. CONCLUSION

The occurrence of dengue virus IgM in the study population was confirmed. Some of the studied subjects were also infected with malaria parasite which is endemic in the study location. Since symptoms associated with dengue fever and malaria are indistinguishable at the prodromal stage, specific diagnostic tests assume critical importance in the differential diagnosis of these febrile illnesses.

ACKNOWLEDGEMENTS

We acknowledge the Department of Microbiology, Ahmadu Bello University, Zaria, Nigeria for providing the platform on which this research was carried out, and the Ministry of Health, Kaduna State, Nigeria for granting ethical consent.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=1087&id=8&aid=8772