Prevalence of malaria as co-infection in HIV-infected individuals in a malaria endemic area of southeastern Nigeria

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Abstract

Background & objective: The present study was conducted on the prevalence of malaria as co-infection amongst 'asymptomatic HIV' and 'symptomatic HIV' subjects to see if such prevalence deviated from that commonly reported in apparently health individuals in same locality.

Methods: A prospective study that involved 196 participants grouped according to their HIV status as: 'asymptomatic HIV seropositive group' (n = 101); 'symptomatic HIV seropositive group' (n = 48) and 'control HIV-seronegative group (n = 47). Blood samples collected from the participants were used for double HIV screening by rapid immunoassay technique and immunochromatographic technique, and for the diagnosis of *Plasmodium falciparum* malaria using rapid *P. falciparum* antigen detection method.

Results: The result showed that the prevalence of *P. falciparum* malaria as a co-infection amongst the asymptomatic HIV seropositive group was 12 (11.8%) and amongst the symptomatic HIV seropositive group was 16 (33.3%). However, the prevalence rate of *P. falciparum* malaria amongst the control HIV seronegative group was 5 (10.6%) and the combined burden of *P. falciparum* malaria amongst both groups of HIV seropositives was 28 (18.9%).

Interpretation & conclusion: The present study observed different prevalence rates of *P. falciparum* malaria amongst the three groups. The prevalence was tripled in symptomatic HIV seropositive group. This shows a clear departure from possible obtainable prevalence of malaria infection alone in this malaria endemic area. Due to the mortality rates associated with malaria infection in an endemic area, it may be necessary that routine malaria screening be adopted as part of the management policy to check the co-infection.

Key words Asymptomatic – endemic – HIV – malaria – prevalence – symptomatic

Introduction

HIV infection is on the increase in the sub-Saharan Africa. This region is also known to be endemic for malaria, particularly *Plasmodium falciparum*[1]. Therefore, it may not be uncommon to observe co-morbidity with both pathogens[2–5]. However, different reports have it that incidence of malaria is not common in HIV-infected individuals[6–7], while others have reported uncommon incidence of malaria in HIV-infected individuals in malaria endemic areas[2–5] although malaria transmission is unstable throughout

the year in these reports. Thus, it may be important to investigate the prevalence of malaria in HIV-infected subjects residing in a malaria endemic area with stable transmission throughout the year. This will help to know if pattern and burden of malaria amongst HIV-infected subjects are similar in all endemic areas irrespective of stable or unstable transmission throughout the year.

Material & Methods

Subjects

This was a prospective study on 196 participants (male = 77; female = 119; age range 2–70 yr) carried out between the months of January and March 2007 at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Anambra state, Nigeria. The participants were grouped as follows based on their HIV status.

Group 1: 'Asymptomatic HIV group' with 101 subjects (male = 30; female = 71). Prior to this study, these subjects did not know their HIV and *P. falciparum* malaria status. The HIV screening confirmed these subjects as HIV seropositive. They were further screened for *P. falciparum* malaria.

Group 2: 'Control group' consisted of 47 participants (male = 24; female = 23). Prior to this study, these subjects did not know their HIV and *P. falciparum* malaria status. The HIV screening confirmed these subjects as HIV seronegative. They were also screened for *P. falciparum* malaria.

Group 3: 'Symptomatic HIV group' consisted 48 participants (male = 23; female = 25). Prior to this study, these subjects knew their HIV status but did not know their *P. falciparum* malaria status. They were those living with HIV and have developed some signs and symptoms. They were screened for *P. falciparum* malaria. However, only 12 of them were placed on anti-retroviral drug.

From each participant in these three groups, 3 ml of blood was collected for HIV screening and confirmation and for *P. falciparum* malaria screening. The participants in the present study gave informed consent and the NAUTH Board of Ethical Committee approved the study design.

Methods

Detection of antibodies to HIV-1 and HIV-2 in human plasma: Two different methods were used namely Abbott determine™ 1 & 2 which is an *in vitro* visually read immunoassay and immunochromatographic test for the qualitative detection of antibodies to HIV-1 & 2 in human plasma. For the Abbott determine™ HIV-1 & 2 the procedure as described by the manufacturer was used for the analysis. Briefly, 50 µl of participants' plasma samples separated from corresponding whole blood samples in EDTA were applied to appropriately labelled sample pad. After 15 min of sample application, the result was read. This method has inherent quality control that validates the results. Two visible red colours in the region labelled control and patient represents HIV seropositive reaction while a single red colour in the region labelled control represents HIV seronegative reaction. For the immunochromatographic method for HIV-1 & 2 it utilises immobilised antigen for the detection of antibodies to HIV-1 & 2 in the plasma. It is used as a point of care test and suitable for use in multi-test algorithms. The procedure as described by the manufacturer was used for the analysis. In brief, 5 µl plasma sample loop provided was used to collect the participants' plasma by touching it on the specimen and allowing the opening of the loop to fill with the liquid. The samples were dispensed into the sample wells in appropriately labelled sample pad. Three drops of the buffer supplied by the manufacturer was added drop-wise into the appropriately labelled sample wells. The results of the tests were read at zero minute after the addition of the running buffer. This method has inherent quality control that validates the results.

The presence of two pink/purple lines in the region of test sample and control indicates HIV seropositive reaction while a single pink/purple line at the control region indicates HIV seronegative reaction. HIV seropositive results' using these two methods were used to classify participants as presenting with HIV infection.

Diagnosis of P. falciparum: Whole blood was used for the diagnosis of *P. falciparum* malaria using Malaria *Plasmodium falciparum* Rapid Test Device (Global device, USA). The principle is based on a rapid chromatographic immunoassay for the qualitative detection of circulating *P. falciparum* antigen in the whole blood. This method utilises Gold conjugate to selectively detect *Plasmodium* antigen. The procedure was as described by the manufacturer. Briefly, 10 μl of the whole blood specimen from the participants were transferred into appropriately labelled specimen cassettes containing sample well. Subsequently, three drops of buffer supplied by the manufacturer (approximately 120 μl) was added into the sample wells. After 15 min the results were read. The test device has inherent quality control that validates the result. The presence of two pink lines at the region of the control and test sample signifies presence of *P. falciparum* malaria infection while the presence of only one pink line in the control region signifies absence of *P. falciparum*.

Results

Out of the 101 asymptomatic HIV-seropositive subjects; 12 (11.8%) had *P. falciparum* malaria as co-infection while the remaining 89 (88.2%) had no *P. falciparum* malaria infection. Similarly, out of the 47 control HIV-seronegative subjects; 5 (10.6%) had *P. falciparum* malaria while 42 (89.4%) had no *P. falciparum* malaria infection. Furthermore, amongst the 48 subjects of the symptomatic HIV-seropositive group, 16 (33.3%) had *P. falciparum* malaria as co-infection while 32 (66.7%) had no *P. falciparum* malaria infection (Table 1). The total percent prevalence

Table 1. Prevalence of malaria infection amongst asymptomatic HIV-seropositive, symptomatic HIV-seropositive and control HIV-seronegative groups

Groups	Malaria –ve	Malaria +ve	Total
Asymptomatic HIV	89 (88.2)	12 (11.8)	101 (100)
Control	42 (89.4)	5 (10.6)	47 (100)
Symptomatic HIV	32 (66.7)	16 (33.3)*	48 (100)

*Three pregnant women inclusive; Figures in parentheses are percentages.

rate of *P. falciparum* amongst both the groups with HIV seropositivity was 18.8% representing 28 *P. falciparum* malaria positive participants out of the 149 (Table 2).

Sex distribution of *P. falciparum* malaria indicated that 15 (45.4%) were males and 18 (54.6%) were females with evidence of *P. falciparum* malaria. However, three male and two female control HIV-seronegative participants were included (Table 3).

Discussion

The diagnosis of *P. falciparum* malaria parasite infection using *P. falciparum* antigen has been widely accepted as a rapid antigen test for *P. falciparum* malaria[8,9]. Its accuracy has also been put at 86–99%

Table 2. Prevalence of malaria and HIV co-morbidity when asymptomatic and symptomatic HIV groups were pooled together compared to malaria prevalence in the control group

Groups	HIV[#]	Control	Total
Malaria –ve	121 (81.3)	42 (89.4)	163 (83.2)
Malaria +ve	28 (18.8)*	5 (10.6)*	33 (16.8)
Total	149 (100)	47 (100)	196 (100)

[#]Both symptomatic and asymptomatic patients were included; *Three pregnant women included; Figures in parentheses are percentages.

Table 3. Sex distribution of malaria infection irrespective of HIV status of participants

Sex	Malaria +ve	Malaria −ve	Total
Male	62 (38.4)[+]	15 (45.4)[*]	77 (39.6)
Female	101 (61.6)[$]	18 (54.6)[#]	119 (60.4)
Total	163 (100)	33 (100)	196 (100)

[+]Twenty males were HIV seronegative; [*]Three males were HIV seronegative; [#]Two females were HIV seronegative; [$]Twenty-one females were HIV seronegative; Figures in parentheses are percentages.

compared with microscopic detection of malaria parasites in smears[10,11] as with very high specificity. It has been recommended for use where microscopic detection of malaria parasites in smears is not possible. However, one of the limitations is that the malaria antigen may still be detected after treatment has been effected with successful clearance of parasites from blood[10].

The prevalence of *P. falciparum* malaria amongst the control subjects was 10.6%. Subjects in this category were HIV seronegative. The prevalence of *P. falciparum* malaria in these subjects is a reflection of the prevalence of this species of malaria in the population. Similar prevalence has been reported from Nigeria amongst blood donors. In their report Erhabor *et al*[12] observed a prevalence rate of 10.2% amongst the blood donors. Similar, prevalence has been reported in Cameroon showing changes in prevalence with age[13] and from rural area in southern Mozambique[14]. This area is known as an endemic area with stable and unstable transmission respectively .

However, amongst the asymptomatic HIV-infected subjects, the prevalence rate of *P. falciparum* malaria as a co-infection was 11.8%. This prevalent rate is closely similar to that observed amongst the control subjects. Since these subjects did not know their HIV status prior to the screening, it may most likely be that same factors limiting or predisposing to malaria may

closely exist in both the groups. It could also be that the HIV infection is still quite recent in the asymptomatic subjects.

Contrastingly, the prevalence rate of *P. falciparum* malaria as co-infection amongst the symptomatic HIV subjects was 33.3%. This was almost tripled compared with other groups. This possibly showed that the factors conferring resistance to this species of malaria might have been compromised in these subjects. Thus this very high rate of malaria co-infection in symptomatic HIV subjects calls for public health concern. Bearing in mind that the study was carried out in malaria endemic area with stable transmission throughout the year. The implication is that they may be exposed to such level of risk of susceptibility throughout the year.

Studies reported elsewhere from malaria endemic area with unstable transmission throughout the year, through recruiting children and adults with malaria infection observed respectively prevalence of HIV in these subjects as 10.1%[4] and 29.9%[3]. This report though from a malaria endemic area with unstable transmission also showed high incidences of malaria and HIV co-infection. Therefore, irrespective of site or location in a malaria endemic area, the problem of HIV and malaria infections calls for concern as both could lead to high mortality rate. Due to high mortality rates associated with malaria infection in an endemic area, it may be necessary that routine malaria screening be adopted as part of the management policy to check the co-infection.

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