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Malarial infection among HIV patients on antiretroviral therapy (ART) and not on ART: a case study of Federal Medical Centre Makurdi, Benue State, Nigeria

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ABSTRACT

Objective: Malarial infection among patients on antiretroviral therapy (ART) attending Federal Medical Centre Makurdi, Benue State was investigated between April and August 2008. **Methods:** A total of 1080 HIV patients were examined (800 on ART and 280 not on ART considered as control). Questionnaire was administered to each participant to collect socio-demographic data. The Cytoflow and Leishman's staining techniques were used to count CD^{4+} and conduct parasitological examination respectively. **Results:** Of the 800 HIV/AIDS patients on ART examined for malaria parasites, 20.5% (164/800) were found positive for malaria infection, while those not on ART had an infection rate of 63.9% (179/280). There was no statistically significant difference of malarial infection between patients not on ART and those on ART (χ^2= 14.05, p= 0.0805). The age group 9-15years recorded the highest infection rate with 55.6% (5/9), while the lowest infection, 15.8% (41/260) was observed in the 30-36 years age group. Malarial infection was higher in patients with CD^{4+}count less than 1073/μL. Females showed higher infection rate (12.6%) than males (7.9%) but with no statistically significant difference (χ^2=1.95, P=0.85). **Conclusions:** It was observed that ART boosts immunity of HIV/AIDS patients against malarial infection, which indirectly is a possible implication for malaria control.

1. Introduction

Malaria affects 40% of the world's population putting 3.2 billion people at risk in 107 tropical countries[1]. It is one of the leading causes of death worldwide, especially in the developing world. It is estimated that 500 million clinical cases and about 3 million deaths occur every year due to malaria, 90% of such deaths occurring in sub-Saharan Africa[2]. Those who are at risk are young children, pregnant women and HIV/AIDS patients whose immunities are compromised.

Malaria and HIV/AIDS are the world's greatest health problems and both diseases are concentrated in the tropical and sub-tropical regions of the world. The number of people living with HIV rose from around 8 million in 1990 to 33 million by the end of 2009[3]. The overall growth of the epidemic has stabilized in recent years. The annual number of new HIV infections has steadily declined and due to the significant increase in people receiving antiretroviral therapy, the number of AIDS-related deaths has also declined[3]. However, about 68 % of all people living with HIV reside in sub-Saharan Africa, the region carrying the greatest burden of the epidemic.

Socio-economically, malaria and HIV/AIDS are exacerbated by ignorance and reinforced by poverty. They often affect the poorest segments of the population, which may be more vulnerable to disease due to lack of access to education, information and state services.

People living with HIV/AIDS are at increased risk of clinical malaria and severe illness, and HIV infection can decrease the protection offered by antimalarial treatment. Malaria contributes to a temporary increase in viral load among HIV-infected people which may worsen clinical disease and increase mother-to-child transmission[4]. Malaria causes anaemia which often requires blood transfusion, a procedure that increases the risk factor for

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HIV infection where universal blood screening has not been achieved. Children and adults who have HIV/AIDS are more likely to experience severe malaria requiring hospitalization and the risk of death[4]. In Nigeria, billions of US$ are lost in the management of the infections and these have slowed economic growth as a result of loss of life and reduced productivity[4]. In 2010, people living with HIV/AIDS were estimated to be at 2 980 000 million, this made Nigeria the second largest country with people living with HIV/AIDS in Africa after South Africa[5]. The epidemic significantly varied between States with Ekiti State in the southwest zone having the lowest prevalence (1%) and Benue State in the North central having the highest (10.6%)[5].

In Benue State, malaria and HIV/AIDS have been overlapping over years; malaria has been prevalent among pregnant women (76.9%), children aged 1-10 years (42.3%) and adults (52.9%)[6,7]. Information on the prevalence of malaria in relation with HIV/AIDS and $CD4^+$ count in Benue State is scarce. Based on the position of the State on HIV/AIDS rating in the country (being in the lead from 1999-2005 except in 2003 when it came second), there was an urgent need to investigate malarial infection among HIV/AIDS patients attending Federal Medical Centre, Makurdi, a referral hospital in the capital city. This study was therefore conducted to determine the level of malaria infection in HIV/AIDS patients on ART and those not on ART with respect to $CD4^+$ counts, age and gender.

2. Materials and Methods

The present study was conducted in Makurdi, capital of Benue State, Nigeria between April and August 2008. A total of 1 080 HIV/AIDS patients attending the Federal Medical Centre Makurdi for monthly check of their $CD4^+$ Cell count and for collection of antiretroviral therapy (ART) were enrolled for the study.

2.1 Study area

The present study was conducted in Makurdi, capital of Benue State, Nigeria between April and August 2008. This period generally corresponds to the rainy season when mosquitoes abound in the environment due to the presence of stagnant water and bushes around houses. Makurdi is located at the heart land of guinea savanna zone of central Nigeria. The climate of the area is tropical and the vegetation characteristic is predominantly guinea savanna with an annual rainfall of 1 090 mm. There are two distinct seasons, the rainy season and the dry season; the former lasts from April to October and the latter from November to March. Makurdi has a temperature range between a minimum of 27. 38 ℃ to 28. 02 ℃ and a maximum of 32.10 ℃ to 36.09 ℃ (Meteolorgical Department, Nigerian Air Force Base Makurdi, Unpub. Data).

2.2. Study design and laboratory investigations

Prior to the commencement of the study, ethical clearance was obtained from the ethical committee of the Federal Medical Centre, Makurdi and all participants provided informed consent and they were also duly educated on the significance of the study.

The study was cross-sectional in design. A total of 1 080 HIV/AIDS subjects that attended the Federal Medical Centre, Makurdi, a tertiary health institution was enrolled for the study. The first group consisted of 800 HIV/AIDS patients that visited the hospital for the collection of antiretroviral drugs and to check their CD4+ Cell count when needed. Their blood samples were collected and examined for malaria parasites. The second group comprised of 280 subjects that did not know of their HIV/AIDS status and visited the hospital for consultation. They presented symptoms of fever, headache, weakness of the body, lack of appetite and cold. Upon doctors' request, they were referred to the laboratory for HIV testing. This latter group was considered as control group and their $CD4^+$ counts were not checked because we were only interested in knowing their HIV status. After collection of their blood for HIV test, those that were found positive were preserved and tested for malaria parasites. HIV and malaria tests were all carried out in the microbiology laboratory of the Federal Medical Centre, Makurdi. Test results were confirmed by at least two technologists before they were recorded. Malaria tests in both groups were done using thick and thin blood films[8]. The CYFLOW (Flow cytometre) was used for absolute counting of $CD4^+$ and $CD8^+$ lymphocytes subsets of the subjects on antiretroviral.

2.2. Statistical Analysis

Data were analyzed using Graphpad prism 5.04. The chi-square test was used to compare prevalence of malarial infection between HIV/AIDS patients that were on ART and not on ART as well as between males and females. The result was considered significant at $P<0.05$ level.

3. Results

Table 1 shows the prevalence of malaria in HIV patients on ART and those not on ART.

Generally, it was observed that HIV patients not on ART recorded higher prevalence of malaria, 63.9% (179/280) than those that are on ART, 20.5 % (164/800). Among the HIV patients not on ART, subjects between the age groups of 2-8 years, 23-29 years and 44-50 years recorded high prevalences of malaria with 66.7% (6/9), 67.9% (36/53) and 73.7% (14/19) respectively. For patients on ART, the following age groups > 50 years and < 22 years recorded 33.3% (9/27) and 26.2% (27/103) respectively. A statistically significant

Table 1.
Malarial infection among HIV/AIDS patients on ART and not on ART attending Federal Medical Centre Makurdi, Benue State, Nigeria .

Age (Yrs)	No. Examinedon ART	No. Positive (%)	No. Examined not on ART	No. Positive (%)
2 – 8	11	5 (45.5)	9	6 (66.7)
9 – 15	9	5 (55.6)	5	4 (80.0)
16 – 22	103	27 (26.2)	21	14 (66.7)
23 – 29	145	24 (16.6)	53	36 (67.9)
30 – 36	260	41 (15.8)	103	64 (62.1)
37 – 43	166	39 (23.5)	67	39 (58.2)
44 – 50	79	14 (17.7)	19	14 (73.7)
> 50	27	9 (33.3)	03	02 (66.7)
Total	800	164 (20.5)	280	179 (63.9)

Table 2.
Malarial infection in relation to $CD4_+$ counts and Sex of HIV/AIDS patients attending Federal Medical Centre, Makurdi, Benue State, Nigeria.

$CD4_+/\mu L$	No. Examined	No. Positive (%)	Male (%)	Female (%)
10 – 275	342	72 (21.1)	27 (8.1)	45 (13.2)
276 – 541	279	64 (22.9)	24 (8.6)	40 (14.3)
542 – 807	112	20 (17.9)	8 (7.1)	12 (10.7)
808 – 1073	39	7 (17.9)	3 (7.7)	4 (10.3)
1074– 1339	10	1 (10.0)	1 (10.0)	0 (0.0)
>1339	28	0 (0.0)	0 (0.0)	0 (0.0)
Total	800	164 (20.5)	63 (7.9)	101 (12.6)

difference was observed in malarial infection between patients on ART and those not on ART (χ^2= 14.05, P=0.001).

Table 2 shows malarial infection in relation to $CD4^+$ counts and sex of HIV/AIDS patients on ART. Patients with $CD4^+$counts of > 800/μL recorded the least prevalence rate 10.4% (8/77), while patients with $CD4_+$ counts < 200/μL and 200–500/μL recorded the highest prevalence rate of malarial infection with 21.1% (72/342) and 22.9% (64/279) respectively. There was no significant difference between malarial infection in relation to $CD4^+$ counts and sex (χ^2= 1.95, P= 0.85). Females were observed having more malarial infection, 23.1% (101/437) than males, 17.4% (63/363) but with no statistical significant difference (χ^2= 0.52, P=0.910).

4. Discussion

The study found that malaria was more prevalent in HIV patients not on ART (63.9%) than those on ART (20.5%). The reduced prevalence of malarial infection among patients on ART may be likely due to the reconstitution of their immune system associated with the administration of the drugs. However, this result agrees with reports of Kasirye *et al*[9] who found antiretroviral treatment associated with a 75% decline in the incidence of malaria in Ugandan HIV patients on ART. However, recent studies also showed that certain antiretroviral agents can inhibit malaria-parasite growth[10]. The high prevalence of malarial infection among patients not on ART could be probably due to their exposure to mosquito bites from their various places of residence. Most of them were remarkably from poor socio-economic status and they came from suburbs in the city and Local Government Areas of the State where there is poor environmental sanitation with presence of stagnant water and bushes around houses. Such environments encourage the breeding of Anopheles mosquito which are the vectors of malaria.

It was observed that the prevalence of malaria was low when $CD4^+$ counts increased and prevalence of malaria increased when $CD4^+$was low. This supports findings of Rosenthal[11] who stated that the deficiency of immune system due to HIV infection should in theory reduce the immune response to malaria parasitemia and therefore increases the frequency of clinical attacks of malaria. With regards to malarial infection in relation to $CD4^+$ counts between males and females, females tend to be more infected (23.1%) than males (17.4%). This could be due to the fact that most females that were examined for the study had no specific occupation when we referred to their socio-demographic data. They could be female sex workers (FSWs) who live in brothel or stay on the streets. Such females could always be exposed to mosquito bites in their brothel with unclean environment or they usually get infected with malaria parasites when they stay during late hours of the night on the streets waiting for their patronizers.

High frequency of malaria was observed at all ages among patients not on ART. This agrees with earlier reports which stated that adults infected with HIV are at increased risk of contracting malaria[12].

Fighting malaria will improve the lives of HIV/AIDS patients in Benue State and Nigeria at large. Thus, a comprehensive malaria program must be a priority for the health authorities, international and Non-Governmental organizations.

Conflict of interest

The authors declare no conflict of interests

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Authors' contributions

AEU and DAW were involved in the conception and design of the study, DAW conducted laboratory analysis. HRS performed data analysis and drafted the paper. AEU critically reviewed the paper and all authors read and approved the final version of the manuscript.

References

[1] Prescott LM, Harley JP, Klein DA. Microbiology. 7th ed. WCB/McGRAW-Hill. 2008; p. 766-749.

[2] WHO. Malaria and HIV/AIDS interactions and implications: conclusions of a technical consultation. WHO, Geneva, 2004. Report no: who/hiv/2004.08.

[3] Global Report. UNAIDS Report on the Global AIDS Epidemic, 2010. ISBN 978-92-9173-871-7.978-92-9173-87

[4] Corbett EL. AIDS in Africa III: HIV-1/AIDS and the control of other infectious diseases in Africa. *Lancet* 2002; **359**(3924): 2177-2187.

[5] USAID. HIV/AIDS health profile in Nigeria. http://www.usaid.gov/our work/global health/aids/Countries/Africa/Nigeria.html.

[6] Houmsou RS, Amuta EU, Sar TT, Adie AA. Malarial infection among pregnant women attending antenatal clinics in Gboko, Benue State, Nigeria. *Int J Acad Res* 2010; **2**(1): 33-36.

[7] Houmsou RS, Amuta EU, Sar TT, Adagba AH. Malarial infection among patients attending a Nigerian semi-urban based hospital and performance of HRP-2 pf rapid diagnostic test (RDT) in screening clinical cases of Plasmodium falciparum malaria. *Trans Med* 2011; **2**(1:5). doi: 10:3823/422.

[8] Cheesbrough M. Medical laboratory manual for countries part 2. 2nd ed. University Press Cambridge; 2000, p. 454.

[9] Kasirye R, Levin J, Munderi P, Okell L, Walker S, Mugisha A, et al. Epidemiology of malaria in HIV infected Ugandan patients on antiretroviral therapy (ART) - a prospective cohort study. 5th IAS conference on HIV pathogenesis, treatment and prevention, Cape town[C]2009, 19th-22nd July, South Africa.

[10] Skinner-Adams TS, McCarthy JS, Gardiner DL, Andrews KT. HIV and malaria co-infection: interactions and consequences of chemotherapy. *Trends Parasitol* 2008; **24**(6): 264-271.

[11] Rosenthal PJ. Cysteine proteases of malaria parasites. *Int J Parasitol* 2004; **34**: 1489-1499.

[12] Layne SP. Principles of infectious disease. Epidemiology/EP/220. UCLA, 2007. www.expertconsult.com