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Malaria and HIV Co-Infection in Patients Attending a Tertiary Health Facility in Rivers state

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ABSTRACT

Malaria and HIV infections are co-endemic as well as of great public health significance in many regions in sub-Saharan Africa. A study to evaluate the prevalence of malaria and HIV co-infection in relation to CD4+ count and malaria parasite intensity was conducted using 1000 (500 HIV positive and 500 HIV negative) consenting outpatients in University of Port Harcourt Teaching Hospital, Rivers State. Blood samples were examined for the presence and intensity of malaria parasites using Giemsa-microscopy and monoclonal antibody test for CD4+ count. An overall malaria prevalence of 38.5% (385 out of 1000) was recorded in this study; age groups 31 – 40years and 41 – 50years had the highest (45.8%) and least (31,5%) malaria prevalence respectively while males and females had prevalence values of 18.4% and 20.1% respectively (P>0.05). Malaria and HIV co-infection prevalence of 37.0% (185 out of 500) and non co-infection prevalence of 40.0% (200 out of 500) were also recorded. Malaria and HIV co-infection is still of public health significance, therefore further studies to elucidate the interactions between malaria and HIV co-infection for better management are recommended.

Introduction

Malaria and HIV are two of the most common and important health problems facing developing countries and the most common infections in sub-Sahara Africa (UNAIDS, 2005). Malaria and HIV/AIDS are both diseases of poverty, they cause poverty and are commonly found among the poor.

Malaria remains one of the leading causes of morbidity globally and nearly half of the global populations are at risk of malaria infection. Malaria and Human Immunodeficiency Virus (HIV) infection accounted for over Three Million deaths in 2007 and Millions more are adversely affected each year (Amuta *et al*., 2014).

The Prevalence of malaria and HIV infection overlaps in most endemic regions and co-infection of these infections have important public health implication. The geographical overlap of these infections has generated global interest in terms of their potential interactions and an integrated control effort in most endemic regions is essentials. While early population-based studies reported no association between malaria and HIV co-infection (Whiteworth *et al*., 2000), recent study from east sub-Saharan Africa indicated malaria as a risk factor of concurrent HIV infection at the population level.

In addition, evidence shows that malaria co-infection with HIV triggers malaria disease progression, increases the risk of severe malaria in adult (Chandramoham and Greenwood, 1998) increase risk of congenital infection and this dual infection fuels the spread of both diseases especially in sub-Saharan Africa. Therefore, malaria with HIV co-infection in an individual may possibly influence further pathogenic progression of both agents resulting in severe morbidity, complications and increased mortality.

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Materials/Methods

Study Area/Study Population

Port Harcourt is the capital city of Rivers State, Nigeria. Rivers State lies on the recent coastal plain of the eastern Niger Delta and University of Port Harcourt Teaching Hospital lies along the Bonny River in the Delta Niger, Coordinates $4^0$53'23'N, $6^0$54'18"E and located in city 360km3 (139Sqi).

Ethical Consideration

Before commencement of the study, ethical clearance was obtained from the Ethical committee of the University of Port Harcourt. The study was conducted between September 2016 and October 2017 in the General Outpatient Department (GOPD) of the University of Port Harcourt Teaching Hospital in Rivers State, Nigeria. The study was carried out among patients attending a tertiary Health facility in Rivers State with malaria and HIV Co-infection. One thousand informed and consenting patients within the age group of 20 – 70years were randomly selected as the study population.

Sample Collection

Intra-venous blood were collected from One thousand (1000) randomly selected from all enrolled study patients by trained laboratory scientists working in the selected healthcare facility. These samples (stored in ethylene diamine tetra acetate bottles) were used to prepare thick and thin smears for microscopy and as well as determining CD4 level of each study participant.

Laboratory Procedures

Thick and thin blood smears from each of the study individuals were made on grease-free slides and stained with Giemsa to determine species of malaria parasites and parasitic density. Parasite intensity was estimated by counting the number of *Plasmodium falciparum* malaria parasites (Parasite

count) per 200 leukocytes per high power field (Number of Parasites/µl of blood). All stained slides were examined by microscopy, using x100 power field under oil immersion.

Procedures for CD4+ Cells

20µl of CD4+ -PE monoclonal antibody was added in a labeled parten tubes containing 20µl of well mixed EDTA blood sample. The content was mixed together several times for 2 minutes and incubated in the dark for 15 minutes at room temperature with intermittent mixing every 5 minutes. After incubation 800l of CD4 diluting buffer was added to each preparation, mixed properly before analyzed on the cyflow counter as described by equipment manufacturer (Jegede *et al*., 2017). All study participants were subjected to CD4 count testing. A normal CD4+ test level is > 500µl (Wade *et al*., 2013).

Procedures for HIV Test

Blood Samples (2ml) were collected by laboratory technician from the study subjects observing all aseptic techniques. Blood samples were left in the syringe to allow separation of serum for 3hrs using the determine HIV rapid test Kit, 2 drops of the serum was dropped on the absorbent pad of the test stripe and allowed to migrate.

The appearance of double lines on the stripe indicated a positive result and the appearance of a single line indicated a negative result. Participants that served as control and those who tested positive to malaria were all subjected to HIV testing to confirm their status.

Statistical Analysis

Data obtained were analyzed using the ANOVA and chi-square to determine correlation between variables. The differences were considered significant at P< 0.05.

Result and Discussions

Plasmodium falciparum was the only *Plasmodium* species identified in the present study. Out of the total of 1000 selected patients in this study, 385 (38.5%) were infected (overall malaria prevalence) while 615 (61.5%) were uninfected (P<0.05) (Table 1).

Table 1. Overall malaria Prevalence in the Study

No Examined	No Infected (%)	No. Uninfected (%)	P-Value
1000	385 (38.5)	615 (61.5)	0.028

The ages of individuals recruited for the study were between 20 – 70years. Highest rate of infection of 45.2% was observed among the age group 31 – 40 years (Table 2). This was followed by the age group 51 – 60 years with infection rate of 40.1%, while age group 41 – 50years had the least infection rate of 31.5% (P<0.05) (Table 2).

A breakdown of the infections on the basis of sex showed malaria prevalence values of 184 (36.8%) for males and 201 (40.2%) for females (Table 3)

Table 2. Prevalence in the Study according to Age.

Age (Years)	No Examined	No Infected (%)	No. Uninfected (%)	P-Value
20 – 30	205	68 (33.2)	137 (66.8)	0.029
31 – 40	325	147 (45.2)	178 (54.8)	
41 – 50	213	67 (31.5)	146 (68.5)	
51 – 60	157	63 (40.1)	94 (59.9)	
61 – 70	100	40 (40.0)	60 (60.0)	
TOTAL	**1000**	**385 (38.5)**	**615 (61.5)**	

A total of 500 confirmed HIV cases were examined for the presence of malaria parasitaemia according to their ages; individuals in age group 31 – 40years had the highest malaria and HIV con-infection prevalence of 57.8% while those in age group 61 – 70years had the least prevalence of 10.0% (P<0.05) (Table 4).

Also, 385 (185 co-infected and 200 non co-infected) malaria positive study participants were examined in relation to malaria parasite intensity according to age. In the study of the 185 co-infected individuals, age group 51– 60, 41– 50, 61–70 and 31–40 had malaria intensity levels of low (30.8%), medium (35.0%), high (100.0%) and very high (2.1%) respectively while in the 200 non co-infected individuals, age group 20–30, 41–50, 61–70 and 51 – 60 had malaria intensity levels of low (48%), medium (59.3%), high (50%) and very high (4.5%) respectively (P<0.05) (Table 5).

Malaria intensity and CD4 Count Levels are shown in table 6. It was observed that out of 185 study participants, CD4 Count Levels ranged from 501–751L, 500L, 136– 400L, and 10–135L which were obtained for malaria intensity while low malaria intensity levels had the highest CD4 count and those with very high malaria intensity had the lowest CD4 count levels (Table 6).

Table 3. Overall Malaria Prevalence in the Study according to Sex.

Sex	No Examined	No Infected (%)	No. Uninfected (%)	P-Value
Male	500	184 (36.8)	316 (63.2)	0.333
Female	500	201 (40.2)	299 (59.8)	
TOTAL	**1000**	**385 (38.5)**	**615 (61.5)**	

Table 4. Overall Malaria and HIV Co-infection in the Study according to age.

Age (Yrs)	No Examined	No Infected (%)	No. Uninfected (%)	P-Value
20-30	94	28 (29.8)	66 (70.2)	0.91
31-40	173	100 (57.8)	73 (42.2)	
41-50	118	42 (35.6)	76 (64.4)	
51-60	75	11 (14.7)	64 (85.3)	
61-70	40	4 (10.0)	36 (90.0)	
TOTAL	**500**	**185 (37.0)**	**315 (63.0)**	

Table 5. Overall Malaria Intensity according to Co-infection and Non Co-infection in the Study.

Malaria Positives	No. Examined	Low	Medium	High	Very High	P-Value
Co-Infected	185	31 (16.7)	58 (31.4)	94 (50.8)	2 (1.1)	0.024
Non Co-infected	200	65 (32.5)	68 (34)	46 (23)	1(0.5)	
TOTAL	**385**	**96(24.9)**	**126(32.7)**	**140 46.4)**	**3 (0.8)**	

Low=1–10P/MF; Medium=10–20P/MF; High = 21 – 30P/MF; Very High = >30P/MF; P/MF = Parasite Load per Microscopic Field

Table 6. Overall Malaria Intensity in Relation to CD4 Count of Malaria and HIV Co-infection among Study Population

Malaria Intensity	No. Examined	CD4 Count Level
Low (+)	31	501-751µL
Medium (++)	58	401-500µL
High (+++)	94	136-400µL
Very High (++++)	2	10-135µL
TOTAL	**185**	

Discussion

Malaria and HIV co-infection are both endemic and life threatening diseases in this part of the world. Our results underscore the higher prevalence of Malaria infection and HIV co-infection in patients attending a Tertiary Health

Facility in Rivers State. In addition, our data showed a 38.5% prevalence of Patients co-infected with malaria and HIV, which is less than 40.5% reported by Onyenekwe *et al*, (2010) from South-East Nigeria and 40.8% reported by Amala and Nwibani, (2015) from Rivers State. The reduction in trend as observed in this study may be due to adequate measures taken in malaria prevention and prompt diagnostic measures. The female population in this study had higher malaria prevalence (36.4%) and this may point to high vulnerability of women especially when they are pregnant. This finding is consistent with the findings by Amala and Nwibani, (2015) which showed 28.6% of the female population were malaria parasite positive than their male counterparts at 37.6%. These results showed continuous decline in malaria prevalence as stated by World Health Organization (2013).

The results in this study showed that there was no significant relationship (P>0.05) in malaria and HIV co-infection among the various age groups; this finding is in agreement with 12.1% and 32% prevalence among the age class reported from Kano, North West and North East by Nwokedi, (2010) and Gambo (2012) respectively. This can probably be explained by unequal exposure to risk factors of contracting the infection. The overall malaria intensity according to co-infection in the study showed a highest parasite density of 50.8% and 32.5% in the non co-infected individuals. This high prevalence agreed with other earlier researchers Kalu *et al*., (2012), Olaseinde, (2010), Abah and Temple, (2015), who all established that there is high prevalence of malaria in Nigeria and which Corroborates the fact that malaria is endemic in Nigeria (CDC, 2012). However, the 50.8% recorded among the co-infected individual clearly indicates that those pathogens could interact synergistically in human host. The HIV infection could impair immune responses to malaria parasite leading to a decreased ability to control parasitaemia (Akinbo and Omoregie, 2012 and Olusola *et al*., 2014). Statistically, a P-value of 0.024 showed a significant difference between the co-infected and the non co-infected according to Parasite density.

The CD4 count level among the study participants revealed that there was a statistical significant difference of (P<0.05) P =0.029. the CD4+ count of HIV and malaria co-infected participants was significantly lower than those of malaria infected alone, HIV infected alone and no malaria, no HIV (those that served as the control) 12-791µL, 801-1110µL, 400-800µL, 920-1120µL respectively. Cellular Immunity is the major defense against malaria infections (Frederick *et al*., 2010). Therefore, the reduction in CD4+ count by the HIV virus predisposes HIV-infected patients to opportunistic parasitic infections (Kurniawan *et al*., 2009). It is generally accepted that a CD4 count <200 cells/µL predisposes HIV-infected persons to opportunistic infections (Frederick *etal*, 2010). In this study, a CD4 count <200 Cells/µL resulted in a significantly higher prevalence of malaria – HIV co-infections. This is probably not surprising since the effect of malaria parasitaemia is usually a short-term drop in CD4+ count rather than long-term suppression.

Conclusion

From the study, it can be concluded that the overall malaria prevalence was observed without significant variation among age groups and sex. Varying intensity of malaria parasitaemia from low to very high was observed for co-infected and non-co-infected cases. CD4+ count level was highest in the control group and least in malaria plus HIV co-infection group. This shows that the two infections combined synergistically to deplete the immune cells.

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