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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 throughout most of the topical and sub-saharan Africa and both present major threat to public health. A study on the prevalence of HIV Co-infection, Malaria interaction and CD4$^+$ count was carried out on 1000 patients attending a tertiary health facility in Port Harcourt Teaching Hospital, Rivers State using Cyflow cytometer and Microscopy for parasite detection. Five Hundred HIV positive individual were examined for the presence of malaria Parasite and CD4+ count level, Two Hundred and Fifty individuals were used to determine malaria intensity in relation to CD4+ count level in HIV negative patients. The results showed higher malaria prevalence of 38.5% and prevalence according to age showed a higher prevalence of 45.8% among age group 31-40 and a lower prevalence of 31.5% among age group 41-50 at p =0.029. females had higher rate of infection with 20.1% prevalence than males with 18.4% in relation to sex at P=0.333 (P>0.05). malaria intensity had highest prevalence of 50.8% and a lowest intensity level of 16.7% at P=0.033. Hence the study suggest that malaria and HIV co-infection requires special medical attention. Further studies to elucidate the interaction between Malaria and HIV for better management are recommended.*
KEY WORDS: malaria parasite, prevalence, co-infection, parasite intensity and Port Harcourt.

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 *eta*l, 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 *etal*, 2000), recent study from east sub-sahara 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-sahara 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.

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 consented patients with 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 participation.

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 densities were estimated by counting the number of *Plasmodium falciparum* malaria parasites (Parasite count) per 200 leukocytes per high powerfield (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 *etal*, 2017). All study participants were subjected to CD4 count testing. A normal CD4+ test level is > 500µl (Wade *etal*, 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

Out of the total of 1000 selected patients in this study, 385 (38.5%) were overall malaria prevalence while 615 (61.5%) were uninfected and malaria prevalence were statistically significant with $P = 0.028$ ($P<0.05$) (Table 1).

Table 1: Overall malaria Prevalence in the Study

No Examined	No Infected (%)	No. Not Infected (%)	P-Value
1000	385 (38.5)	615 (61.5)	0.028

The age group recruited for the study were between 20-70 years. Highest rate of infection of 147(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 of63(40.1%), while age group 41-50 years had the least infection rate of 67(31.5%), with P-value (0.029).*Plasmodium falciparum*was the only Plasmodium species identified in the present study (Table 2).

In terms of sex, males and females were examined. A breakdown of the infections on the bases of sex shows 184 (36.8%) for males and 201 (40.2%) were females, giving a total of 385 (38.5%) while a total of 615 (61.5%) were not infected as presented in (Table 3)

Prevalence in the study according to age

Age (Yrs)	**No Examined**	**No Infected (%)**	**No. Not Infected (%)**	**P-Value**
20-30	205	68 (33.2)	137 (66.8)	
31-40	325	147 (45.2)	178 (54.8)	
41-50	213	67 (31.5)	146 (68.5)	0.029
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)**	

Table 3: Overall Malaria Prevalence in the study according to sex

Sex	No Examined	No Infected (%)	No. Not Infected (%)	P-Value
Male	500	184 (36.8)	316 (63.2)	
Female	500	201 (40.2)	299 (59.8)	0.333
Total		**385 (38.5)**	**615 (61.5)**	

Total of 500 confirmed HIV cases were examined for the presence of malaria parasitemia according to their ages. Individuals in age group 31-40 had the highest malaria prevalence of 100 (57.8%) out of 173 infected while those in age group 61-70 have the least malaria prevalence of 4 (10. %) of 40 sampled infected (Table 4).

385 co-infected and non-co-infected individuals 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 prevalence of malaria intensity levels of, low (30.8%), medium (35.0%) high (100.0%) and very high (2.1%) respectively. Also, the 200 non co-infected individuals in age group 20-30, 41-50, 61-70 and 51-60 had prevalence of malaria intensity levels of low (48%),

medium (59.3%), high (50%) and very high (4.5%) respectively. (Table 5) variations in the overall malaria intensity prevalence according to co-infection and nonco-infection in relation to age was statistically significant with P = 0.031.

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

Age (Yrs)	No Examined	No Infected (%)	No. Not Infected (%)	P-Value
20-30	94	28 (29.8)	66 (70.2)	
31-40	173	100 (57.8)	73 (42.2)	
41-50	118	42 (35.6)	76 (64.4)	0.91
51-60	75	11 (14.7)	64 (85.3)	
61-70	40	4 (10.0)	36 (90.0)	
Table	**500**	**185 (37.0)**	**315 (63.0)**	

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

Intensity of malaria parasite (%) Low (%) Medium (%) High (%) Very High (%) parasite Load Per Microscopic Field

	No. Examined	(3-10)	(10-19)	(19-30)	(>30)	P-Value
No Infected	185	31 (16.7)	58 (31.4)	94 (50.8)	2 (1.1)	
Non Co-infected	200	65 (32.5)	68 (34)	46 (23)	1(0.5)	0.024
Total	385	96 (24.9)	126 (32.7)	140 (46.4)	3 (0.8)	

DISCUSSION

Malaria and HIV co-infection are both endemic and life threating 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 *etal,* 2010 from South-East Nigeria and 40.8% reported by Arnala and Nwibani (2015) from Rivers. The reduction in trend as observed in this study may be due to adequate measures taken in malaria prevention and prompt diagnostic measures. Females population in this study is more effected with 36.4% prevalence. This may point to high vulnerability of women especially when they are pregnant. This finding is consistent with the findings by Arnala and Nwibani (2015) which showed 28.6% of the female population were malaria parasite positive than their male

counterparts at 37.6% more than 1.2% reported for male in this study. These results showed continuous decline in malaria prevalence as stated by World Health Organization (2013). Age group affected in this study were within 31-40, 51-60 and 61-70 respectively.

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**	

Malaria intensity and CD4 Count level 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).

The prevalence of malaria infections by age (Table 2) showed that the highest percentage of 147(45.2%) was recorded among the age group 31-40 years followed by those within the age group 51-60 years with 63(40.1%) while those within the ages 41-50 years had the lowest percentage of infections of 67(31.5%). However, the highest malaria and HIV co-infection in relation to age was recorded among those in age 31-40 years with 100(57.8%), followed by those in ages 41-50 years with (35.6%) and the least malaria and HIV co-infection was recorded among age group 61-70 years with 4(10.0%).

The study figured out no significant difference (P = 0.91) in HIV among the 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 *etal*, 2012, Olalselinde , 2010, Abah and Temple, 2015, who had 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 parasitemia (Akinbo and Omoregie, 2012 and Olusola *etal*, 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 *etal*, 2010). Therefore, the reduction in CD4+ count by the HIV virus predisposes HIV-infected patients to opportunistic parasitic infections (Kurniawan *etal,* 2009). It is generally accepted that a CD4 count < 200 cellsµL 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 parasitemia 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 parasitemia 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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