Malaria and HIV Co-infection among COVID-19 Cohort in Selected Healthcare Facilities in Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: The COVID-19 pandemic began while improvement in malaria control and elimination had reached a peak. COVID-19 affected routine services particularly those for other killer infectious diseases including, HIV/AIDS and Malaria. This resulted in slowing progress in achieving control programs targets.
Aim: The study was aimed at evaluating malaria and HIV coinfection among COVID-19 cohort in selected healthcare facilities in Rivers State of Nigeria.
Methodology: The observational study showed a snapshot sampled only patients within the COVID-19 approved centers who consented to participate within the selected study area otherwise excluded. Simple random sampling technique was used to select 400 participants, giving subjects equal opportunity of participation. The majority of the data came from primary sources, but secondary sources were also used. Malaria testing was perform using microscopic method. Result outputs were presented on tables and charts.

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Results: The study showed high prevalence of malaria infection among COVID-19 patients -327 (81.8%) but low rate of HIV co-infection- 2 (0.5%).
Conclusion: Much consideration should be channeled towards malaria endemicity and coinfection with COVID-19 unless it confers protective advantage as postulated by some studies however, a large scale and more in-depth study is suggested.

1. INTRODUCTION

Malaria is amongst the diseases that have threatening to humanity, it is mostly spread through the bite of infected female Anopheles mosquito caused by *Plasmodium* parasites. About 241 million malaria cases and 627 000 malaria deaths was estimated worldwide in 2020, African is said to have the highest cases [1].

HIV infection usually result to reduced number of CD4 T cells, leading to AIDS, AIDS refers to a CD4 T-cell count < 200 cells/µL [2]. HIV (Human Immunodeficiency Virus) is a virus that destroys the CD4. HIV is a major public health issue globally by the end of 2020 about 37.7 million lived with HIV over two thirds of whom (25.4 million) are in the WHO African Region. HIV virus has two main means of transmission horizontal and vertical transmission. Horizontal transmission is as a result of unprotected physical contact and may include unprotected sex with the affected victim, blood transfusion of infected blood. However, vertical transmission is direct transfer of virus from mother to child during pregnancy, breastfeeding or at delivery [3].

It is estimated that COVID-19 pandemic has spread to over 52 million persons and caused 1.2 million deaths from the time it was discovered in 2019 at Wuhan China [4]. The first country in African were COVI-19 was first reported is Egypt in February 14, 2020 and has since spread across the region causing about 1.9 million infections and 46,000 deaths, [5]. The population affected with covid-19 in Sub-Saharan Africa is relatively low compared to global proportion of COVID-19 cases and deaths in other continents.

Though Africa has a relatively low proportion of COVID-19 cases and deaths compare with other continents [6]. It has an excessively higher burden of other infectious diseases, like malaria and HIV/AIDS. The possible effects of COVID-19 in controlling these diseases and any possible effect of clinical interactions between COVID-19 and these diseases is still a major public health concern in Africa, hence the need for this study.

Also, this study would help in the understanding of the epidemiology and clinical course of COVID-19 with Malaria and HIV infection [6].

COVID-19 pandemic has caused disruptions in the prevention of HIV and malaria including treatment. Global fund report states that the COVID-19 pandemic threatens to reverse global progress in combating HIV and malaria. Specifically, malaria had halted progress with about 4% decrease in testing and a 0.5% treatment reduction. However, some prevention efforts heightened like the distribution of bed nets rose by 17% and use of mosquito spray increased by 3% in addition to 1% increase prophylactics administered to pregnant women who received preventive treatment for malaria [7,8].

The impact of COVID-19 has been massive to HIV prevention and control. Notwithstanding the progressing rate of people living with HIV/AIDS taking antiretroviral therapy, the decline in prevention services and testing in the COVID-19 pandemic period specifically the heat of it in 2020 were disturbing. Services such as public health HIV prevention outreach programs and services reduced by 11%. Also, HIV testing programs accessed decreased by 22% compared to the preceding pandemic year (2019). This disrupting consequence of the COVID-19 pandemic has placed those at risk of infection to have minimal access to the information and requisite tools for protection [8].

COVID-19 was first reported in Wuhan, China, on 8 December 2019 and declared a pandemic by the World Health Organization (WHO) on 11 March 2020 affecting about 185 countries [4]. 45 countries out of these are in the WHO African region with endemic record of malaria and human immunodeficiency virus (HIV) with approximately 8767 confirmed COVID-19 cases and 413 deaths attributed to COVID-19 as of 13 April 2020. However, Africa has lower number of cases and deaths attributed to COVID-19 [9,10,4] although, cross country variation in the case fatality rate in the WHO Africa region exits

[10]. The low rate of COVID-19 in the region of this study can be explained by age demography of the region comprising mainly of young people [11-14].

Amimo et al. [15] also attributed that to low testing in the area as most testing were done only following symptom presentation. Maze et al. [16] suggested accurate diagnosis and prompt treatment as a measure to control malaria morbidity and mortality. Remarkably, COVID-19, malaria, and HIV share similar symptoms in some cases including cough, fever and others. The similarity of these symptoms poses significant concerns to the current measures to control, not only COVID-19, but the other diseases too [15].

The challenges posed by COVID-19 pandemic are enormous, the scarcity of published data on triple co-infection of malaria, HIV and COVID-19 heightened the researchers' interest to put it into consideration and investigate the rate of malaria and HIV co-infection among COVID-19 patients. The burden of single infection is big and much overwhelming in co-infection hence; information from the study is crucial and useful for clinicians for clinical management of patients. The study was focused at evaluating malaria and HIV coinfection among COVID-19 cohort in selected healthcare facilities in Rivers State of Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Rivers state, Nigeria. Rivers state is one of the states in the Niger Delta region found in South-South Nigeria. The state comprises of twenty-three local government areas and Port Harcourt is the capital of the state. The state has two tertiary hospitals and referral centers and other secondary hospitals and twenty-three primary healthcare centers managed by the government.

2.2 Study Design

The study is a descriptive observational design which investigated the prevalence rate of malaria and HIV among COVID-19 patients in selected healthcare facilities in Rivers State of Nigeria.

2.3 Inclusion Criteria

Conditions for recruitment and inclusion into this study were based on certain criteria such as;

participants' approval and consent to participate in this study. Informed written consent was obtained from each subjects otherwise exclude. Also, only COVID-19 patients on admission within the designated healthcare facilities were included. Males and females had the same chances of taking part, as long as they were in the selected facilities.

2.4 Exclusion Criteria

Exclusion from this study was on the bases of lack of consent by the patients, patients on unconscious state, COVID-19 patients found outside the selected accredited healthcare facilities, and those currently or recently treated for malaria parasite infections.

2.5 Sample Size

Sample size of 400 was obtained following Cochrane sample size calculation for descriptive study. This was the size of the sample, and 400 patients from the chosen healthcare facilities were asked to take part.

2.6 Sampling Technique

Simple random sampling technique was used as sampling technique. The choice provided subjects equal opportunity of participating in the study [17,18]. Random selection of the available healthcare facilities accredited for COVID-19 and thereafter, random selection of patients using the hospital register as the sample frame. All patients within the selected health facilities who met the inclusion criteria and gave consent participated in the study.

2.7 Laboratory Procedure

Conventional microscopy was used to carry out the malaria test following the procedure of thin and thick film making and smear. The smear was passed through staining using Geimsa stain which was latter viewed using the light binocular microscope. HIV testing was conducted using sequential approach. Serology testing was done using rapid detection kit from Alere and statpack for confirmatory. All laboratory procedures followed the standard clinical laboratory practices according Chessbrough [19].

2.8 Statistical Analysis

Statistical analysis was performed with the use of Microsoft excel spread sheath for descriptive

statistics. Percentage and frequency distribution were obtained, also, prevalence rate calculated. Results were presented on tables and charts.

3. RESULTS

Table 1 and Fig. 1 illustrate malaria and HIV coinfection in a cohort of four hundred (400) COVID-19 study participants showing malaria infection rate of 327 (81.8%) and undetectable malaria infection rate of 73 (18.2%) among COVID-19 patients in the study population. The study result assumed marked malaria detection among the study population which implies a high malaria parasitaemia in the area of study.

On the other hand, the prevalence rate of HIV infection among the study population – cohort of COVID-19 patients appeared small 2 (0.5%) while 398 (99.5%) were negative to HIV infection. Comparatively, malaria parasitaemia among COVID-19 was high compared to HIV co-

infection with COVID-19 as revealed in the study.

4. DISCUSSION

The COVID-19 pandemic began while improvement in malaria control and elimination had reached high level [15]. COVID-19 affected routine services particularly those for other killer infectious diseases including, HIV/AIDS and Malaria. This resulted in slowing progress in achieving control programs targets. The study investigated the prevalence of malaria, HIV co-infection among COVID-19 patients in selected health facilities in Nigeria.

This study recorded high detection of malaria infection among the study population (COVID-19 patients). Also, a high prevalence rate of 81.80% malaria coinfection with Covid-19 was recorded. The outcome of a high prevalence in malaria co-infection with COVID-19 maybe due

Table 1. Malaria and HIV co-infection among COVID-19 study participants

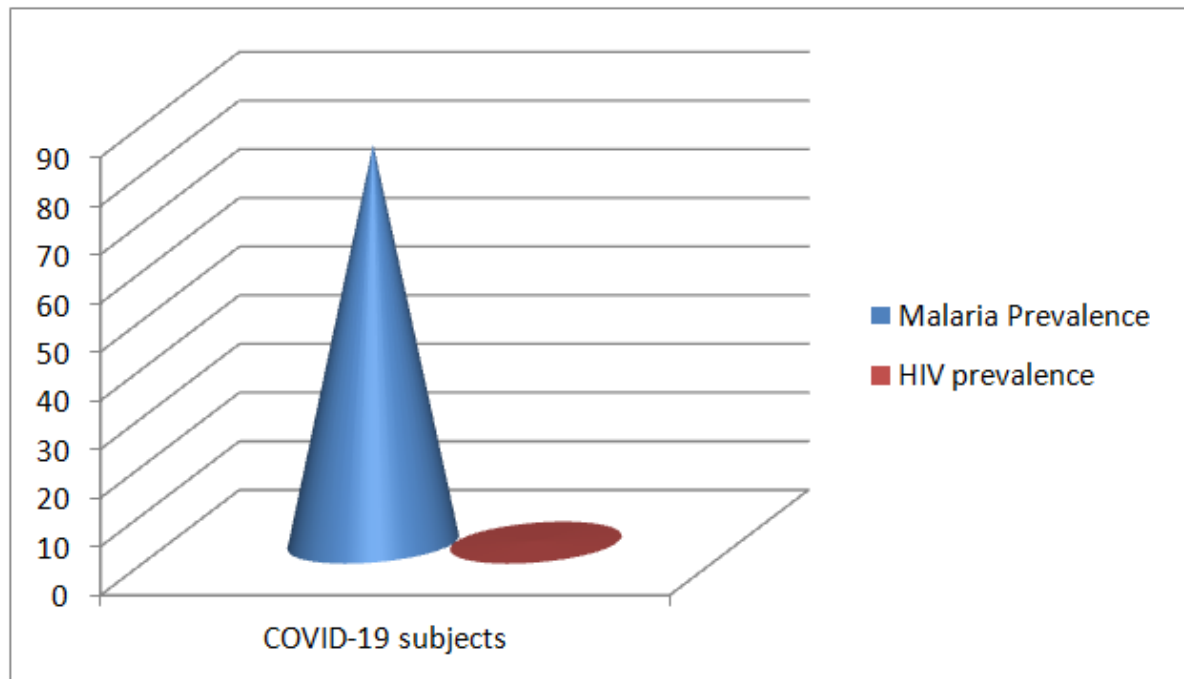| Study Participants	Number Examined	Malaria Infection (%)		HIV Infection (%)	
		Number Infected	Number Uninfected	Number Infected	Number Uninfected
COVID – 19 Patients	400	327 (81.8)	73 (18.2)	2 (0.5)	398 (99.5)

Fig. 1. Prevalence of co-infection with malaria and HIV among COVID-19 patients

to high malaria parasitaemia in the study area. The result is consistent with some research previously carried out.

World Health Organization estimated that 241 million malaria cases and 627,000 malaria deaths were recorded worldwide as at 2020, a rise 14 million cases and 69,000 deaths compared to 2019, with 47,000 deaths specifically due to COVID-19 related disruptions of malaria prevention, diagnosis, and treatment services [20]. This is evident in the high rate observed in this study despite the low rate of triple co-infections of COVID-19, malaria and HIV. The high rate of malaria in this study can be explained by these pandemic disruptions in addition to climatic change as well as mobility. Furthermore, poor and late health seeking behavior as a result of lack of access as well as pandemic restriction is a contributory factor.

Malaria and COVID-19 coinfection is said to be complex since malaria and COVID-19 have common symptoms, even though COVID-19 is more aggressive in adults while malaria affects more children [21].

On the other hand, the occurrence of malaria and COVID-19 co-infection has been found to be of advantage for COVID-19 patients due to the immune response and choloroquine and its derivatives. Research has revealed possibility of cross immunity, where a pathogen can provide immunity against another pathogen. Studies also have discovered that SARS-CoV-2 uses the angiotensin-converting enzyme 2 (ACE2) receptor to enter the host cells [22]. More so, it has also been discovered that ACE1 and ACE2 polymorphisms protects the host from susceptibility. Additionally, studies have reported that interferons generated by lymphocytes which serve as an immune response to malaria have in vitro and in vivo efficacy against the coronavirus responsible for COVID-19.

The prevalence rate of HIV infection among the study population – cohort of COVID-19 patients which appeared low 2 (0.5%) in this study. This is similar to a case report by Toombs et al among 3 people living with HIV who were infected with coronavirus [23]. They reported low prevalence (0.34%) of human immunodeficiency virus (HIV) in their studied population of 500 000 people suffering from COVID-19 in their hospital. This is also consistent with the report from other studies on HIV and COVID-19 co-infection, there was no risk of coinfection.

Furthermore, Toombs and colleagues reported a patient living with HIV who had a high viral load of greater than one million copies per mL and a low CD4 count of 50 cells per µL. Notwithstanding, the adverse immunologic profile, the patient recovered from COVID-19 and was discharged. Their observation is consistent with other studies. The above observation is consistent with the clinical cure of at least four patients with COVID-19, who were newly diagnosed with HIV [24].

Consequently, the study done by Thirumalaisamy and colleague reported that there is an indirect effect of the COVID-19 on HIV and Malaria infections in Africa. They explained that since the emergence of COVID-19, the availability of treatment and prevention materials is low and could cause increased mortality rate [25]. This is similar to the research done by Vaughan who postulated that people with HIV and malaria may not go to healthcare facilities because of the fear of being infected with coronavirus would suffer the severity of both HIV and malaria [26].

Although the prevalence of COVID-19 and HIV co-infection showed low in this study, HIV/AIDS prevention and control have suffered drawback. A team of researchers model estimate predicted disruption which has impacted negatively [27]. About 50% distraction of condoms distribution and use in the population was predicted to raise incidence rates by 1.19 times, and a fold increase in HIV mortality. This prediction affected the service delivery which might have influenced the number of co-infection observed in this study as these disruptions could be the reason for low turnout and in-turn low detection rate.

5. CONCLUSION AND RECOMMENDA-TION

Malaria and HIV have been endemic in the region of this study with numerous efforts to combat the threat which have yielded success at a point. The COVID-19 pandemic started at a time at the peak of prevention and control of malaria and HIV attained marked improvement thereby affecting the achieved progress prior to the pandemic.

The study evaluated co-infections of malaria and HIV among COVID-19 patients with a resultant account of low prevalence rate within the population tested however, high rate of malaria prevalence was reported. The study suggests

scale up of malaria prevention, control and elimination programme in malaria endemic area.

Low rate of co-infections of malaria, HIV and COVID-19 could possibly be fear of being tested restricting people from getting involved therefore, campaigns encouraging people to overcome those fears will be one way to mitigation. More studies are required to evaluate triple co-infections of malaria, HIV and COVID-19 as well as the clinical effect or relationship of this co-morbidity.

ETHICAL APPROVAL AND CONSENT

Ethical approval was obtained from the authorities of the selected healthcare facilities. Also, the laboratory heads gave approval prior to the use of the various laboratory sections. Informed written consent was obtained per participants. Researchers remained committed to privacy and confidentiality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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