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Malaria Prevalence in COVID-19 Patients: Severity, Management, and Outcomes

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ABSTRACT

Coronavirus disease (COVID-19) is caused by a novel strain of coronavirus, while malaria is a parasitic infection triggered by Plasmodium protozoans, transmitted via Anopheles mosquitoes. The simultaneous occurrence of both malaria and COVID-19, and their interplay, remains poorly documented. This study aimed to investigate the correlation between malaria and COVID-19, focusing on the disease's severity, treatment strategies, and clinical outcomes. The research was conducted in isolation centers in Khartoum State, from October to December 2020, as a prospective hospital-based study. Participants were selected using a total coverage sampling method from three centers in Khartoum. A total of 143 individuals participated in the study, all of whom were confirmed COVID-19 patients by PCR testing. Data were collected through patient questionnaires and medical record reviews. Malaria was diagnosed in 115 patients (80.4%), with fever being the predominant symptom in all cases, followed by fatigue in 125 (87.4%), cough in 115 (80.4%), and headache in 83 (58.1%). The findings indicate that there is a significant association between COVID-19 and malaria, such that patients with both diseases simultaneously showed better clinical outcomes compared to patients with COVID-19 alone (P-value = 0.036). The results suggest that malaria treatment may have a positive impact on the recovery of COVID-19 patients. Due to the widespread prevalence of COVID-19, PCR testing was routinely performed for any malaria-diagnosed patient.

Keywords: Treatment, COVID-19, Severity, Malaria, Comorbidity

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Introduction

COVID-19, a disease caused by a novel strain of the coronavirus, has emerged as a global health challenge [1]. Although most individuals experience mild respiratory symptoms and recover without requiring medical intervention, older adults and those with pre-existing conditions such as diabetes, heart disease, respiratory illnesses, and cancer are more vulnerable to severe manifestations of the disease [2]. Previous coronavirus outbreaks, including the severe acute respiratory syndrome (SARS) in 2002 in China and the Middle East respiratory syndrome (MERS) in 2012 in Saudi Arabia, resulted in significant morbidity, affecting thousands of individuals [3]. In December 2019, a new coronavirus, COVID-19, emerged in Wuhan, China, and quickly spread worldwide [4].

Malaria, caused by protozoan parasites from the genus *Plasmodium*, is transmitted by *Anopheles* mosquitoes. It remains one of the leading causes of death in low-income regions and is a major global health issue [5]. While many countries have successfully eliminated malaria, approximately 100 countries remain malaria-free [6, 7]. The simultaneous occurrence of COVID-19 and malaria has not been thoroughly explored or documented [8], although there are indications that both diseases may be related [9]. The ongoing COVID-19 pandemic has disrupted malaria prevention and treatment efforts, and healthcare providers face increased risks of contracting the virus while delivering care [10]. In malaria-endemic regions, the lower incidence of COVID-19 has sparked interest in a potential link between the two diseases, prompting further research [11].

In Sudan, both malaria and COVID-19 are common febrile illnesses with high rates of morbidity and mortality, significantly burdening the healthcare system [12]. To date, no studies have explored the relationship between malaria and COVID-19 within the Sudanese context. This study seeks to examine the association between these two diseases, focusing on their severity, management strategies, and clinical outcomes.

Materials and Methods

This study was conducted prospectively in isolation centers across Khartoum state, Sudan, including Royal Care Hospital, Ibrahim Malik Hospital, and Alshaab Hospital, between October and December 2020. We included all COVID-19 patients diagnosed during this period who were willing to participate. Patients who declined to participate or came from other isolation centers were excluded from the study. The total coverage sampling method was used, selecting 143 participants across the three hospitals: 94 (65.7%) from Royal Care Hospital Isolation Center, 27 (18.9%) from Ibrahim Malik Hospital Isolation Center, and 22 (15.4%) from Alshaab Teaching Hospital.
Data were gathered from the patients and their medical records, following written consent. A questionnaire was used by the principal researcher to capture key study variables, including the participants' socio-demographic information (age, gender), malaria blood film results (BFFM), co-morbidity status, and patient outcomes.

Data Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24. Categorical data were described using frequencies and percentages. A P-value < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Sudan Medical Specialization Board (SMSB) and EDC. Additionally, approval was granted by the administration of the participating hospitals. All participants provided written informed consent before enrollment in the study.

Results and Discussion

A total of 143 individuals were included in this research, representing a range of age categories. Many of the participants had pre-existing medical conditions, with diabetes mellitus being the most common, affecting 55% of the cohort (**Table 1**). Fever was the predominant symptom observed in all participants (100%) (**Table 2**). Additionally, the participants faced various complications, with sepsis being the most prevalent, affecting 52% of the cases (**Table 3**).

Table 1. Co-morbidities distribution among study participants (n = 143)

Co-morbid illness	Frequency (%)
Diabetes mellitus	79 (55.2 %)
Hypertension	34 (23.8 %)
Asthma	22 (15.4 %)
Renal disease	24 (16.8 %)
Chronic obstructive pulmonary disease	1 (0.7 %)
Cardiovascular	41 (28.7 %)
Malignancy	4 (2.8 %)
None	3 (2.1 %)

Table 2. Presenting symptoms of the study participants (n = 143)

Presenting symptoms	Frequency (%)
Fever	143 (100 %)
Fatigability	125 (87.4 %)
Cough	115 (80.4 %)
Headache	83 (58.1 %)
Vomiting	8 (5.6 %)
Diarrhea	19 (13.3 %)
Shortness of breath	72 (50.3 %)
Tachypnea	62 (43.3 %)
Oxygen saturation less than 93	52 (36.4 %)
Loss of appetite	1 (0.7 %)
Shock	1 (0.7 %)

Table 3. Complications among the study participants (n = 143)

Complications	Frequency (%)
Severe pneumonia	22 (15.4 %)
Respiratory failure	14 (9.8 %)
Organ failure	3 (2.1 %)
Sepsis	75 (52.4 %)
Septic shock	3 (2.1 %)
None	45 (31.5 %)

A notable correlation was identified between the patient's age and the outcomes (P = 0.00) (**Table 4**). Additionally, outcomes significantly differed between individuals suffering from both Malaria and COVID-19, compared to those without Malaria (P = 0.036) (**Table 5**). Furthermore, the treatment provided for Malaria showed a substantial association with the outcomes of the patients (P = 0.000) (**Table 6**).

Table 4. Association between age and the outcome of the participants (n = 143)

Age groups (in years)	Death	Discharge in good condition	Full recovery	Total	P-value
25-30	0	0	1	1 (0.7 %)	
35-40	0	2	1	3 (2.1 %)	
40-45	0	4	4	8 (5.6 %)	
45-50	1	7	4	12 (8.4 %)	
50-55	0	8	6	14 (9.8 %)	
55-60	0	17	15	32 (22.4 %)	0.00
65-70	4	12	8	24 (16.8 %)	
70-75	4	13	1	18 (12.6 %)	
75-80	11	6	3	20 (14 %)	
80-90	9	0	1	10 (7 %)	
> 96	1	0	0	1 (0.7 %)	

Table 5. Outcome of patients with malaria and COVID-19 compared to those without Malaria (n = 143)

Patient tests for Malaria	Outcome			Total	P-value
	Death	Discharge in good condition	Full recovery		
Negative	11 (7.7%)	11 (7.7%)	6 (3.5%)	28 (18.9%)	
Positive	19 (13.3%)	58 (40.6%)	38 (26.6%)	115 (80.4%)	0.036*
Total	30 (21.0%)	69 (48.3%)	44 (30.8%)	143 (100%)	

Table 6. Medications received for Malaria and the outcome cross-tabulation (n = 143)

Medications received for Malaria	Outcome			Total	P-value
	Full recovery	Discharge in good condition	Death		
Artemether-lumefantrine	39 (27.3%)	49 (34.3%)	9 (6.3%)	97 (67.8%)	0.000

Artesunate intravenous	0 (0%)	10 (7%)	10 (7%)	20 (14%)
None	5 (3.5%)	10 (7%)	11 (7.7%)	26 (18.2%)
Total	44 (30.8%)	69 (48.3%)	30 (21%)	143 (100%)

In this research, approximately 80% of the individuals involved were diagnosed with malaria, and over two-thirds were discharged in stable health. A significant correlation between malaria and COVID-19 was found in this study [13]. When comparing these findings to data from countries such as Nigeria (25%), the Democratic Republic of the Congo (11%), Mozambique (5%), and Uganda (4%), this rate stands out as considerably higher [7]. It is essential to highlight that sub-Saharan Africa experiences the greatest malaria burden, accounting for around 92% of global cases. In 2019, there were approximately 229 million malaria cases globally, resulting in 409,000 deaths [6]. The research indicated that fever was the predominant symptom, with fatigue, cough, headaches, tachypnea, and oxygen levels below 93% also being commonly observed [14]. This aligns with another study in which fever (58.66%) was reported as the most common symptom, followed by cough (54.52%), dyspnea (30.82%), fatigue (28.16%), and other complaints [15].

Artemether-lumefantrine emerged as the most frequently used treatment in this cohort [16]. Drug resistance remains a significant obstacle to controlling malaria, contributing to increased morbidity and mortality rates [17]. Resistance has been documented in *Plasmodium falciparum* and *Plasmodium vivax*, the two leading malaria-causing species. In response to this, artemisinin-based combination therapies (ACTs) have been widely adopted, with Artemether-lumefantrine being the most prevalent [18, 19].

More than 80% of participants required ICU admission during their treatment [20]. This rate is consistent with a meta-analysis by Derbie *et al.* [18], which observed ICU admission rates for COVID-19 patients ranging from 3% to 100%. Some studies suggest that living in malaria-endemic regions might result in better outcomes and reduced risk of severe COVID-19, though the mechanisms behind this phenomenon remain uncertain [21, 22].

The study also found a significant relationship between age and patient outcomes [23]. According to the Centers for Disease Control and Prevention (CDC), older individuals are at higher risk for severe illness from COVID-19 [24]. Additionally, the study indicated that patients with both malaria and COVID-19 tended to fare better than those with COVID-19 alone [25]. While various studies from different regions support the association between malaria and COVID-19, further investigations are needed to understand the precise impact of malaria on COVID-19 outcomes [10, 26].

Conclusion

This study identified a significant correlation between COVID-19 and malaria, with evidence suggesting that malaria treatment could positively impact the clinical outcomes of affected individuals. Given the widespread nature of COVID-19, it is recommended to test all malaria-positive patients for COVID-19 and initiate the corresponding treatment protocol.

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Ethics Statement: None

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