ABSTRACT

The study aim to evaluate the cases of malarial fever in patients with and without sickle cell disease admitted within the year 2017 to 2020 in some health facilities at Ifako-Ijaye, Lagos state. The study adopted a retrospective cohort study. Data collected, reviewed and subjected to analysis were for patients in admission between January 2017 and December 2020. The results showed 24,599 (52.5%) of the patients were male while (22,267) 47.5% were female for the records used. Age group indicated that 49.2% of the patients were with age 1-10 years which was the highest percentage, followed by age 11-20 years which were 30.3%. Malaria cases of 17.0% were admitted in 2017 and 23.2% in the year 2018 and 21.1% were admitted in year 2019 while 38.7% which was the highest patient percentage was admitted in 2020. Mortality status showed that 55.7% of the patient were male while 44.3% were females, indicating that males seen to be more susceptible to malaria. The age group of majority of the mortality cases; 85.8% were within age 1-10 year confirming that children are the most vulnerable human population to malaria disease, which includes male and female. Sickle cell anemia patients were recorded to be minor in the admitted malaria cases but significant in the mortality proportion to those without sickle cell disease.

Keywords: Mortality, Malaria, Sickle Cell disease, Patients, Incidence

Introduction

About 82 % of global cases of malaria and 90 % of global malaria deaths cases respectively has occurred on the African continent (World Health Organization, 2014). Malaria kills a child under the age of five every two minutes in Sub-Saharan Africa, such as Nigeria. Hemoglobinopathies are thought to protect against malaria's severe life-threatening manifestations (Taylor *et al.,* 2013; W.H.O., 2018). Epidi *et al*., (2018) reported that malaria disease are transmitted through bites from infected female *Anopheles* species of mosquito and are caused by *Plasmodium* species. Symptoms of malaria fever appear seven days or more (typically between 10 and 15 days) after infection, and these include chills, fever, headache and vomiting, which might be mild and difficult to distinguish from other illnesses. Severe anemia, respiratory distress as a result of metabolic acidosis and brain malaria are all common in children with severe malaria (Ruiz Lopez *et al.,* 2014).

The human spleen contributes significantly to the immunity that arises from repeated malaria incidences (Ehimen *et al.,* 2013). According to Buffet *et al.,* (2011), in people with decreased splenic function, parasite clearance is likely to take longer. With sickle cell anemia, hyposplenism occurs and this explains the diminished malaria protection. Sickle cell disease, on the other hand, is a severe public health hazard caused by mutation in the gene coding for

the hemoglobin (Hb)S mutant allele, as opposed to HbA allele, which is the wild type (Piel *et al.,* 2013). This mutation in homozygous individuals produces sickle cell anemia; a dreadful disease, which was virtually frequently fatal before modern therapies were introduced (Ehimen *et al.,* 2013).

Worldwide, sickle cell disease is found in approximately 25 million people, in Sub-Saharan Africa, about 12–15 million people are living with it, and roughly 300,000 infants with the gene are born each year (Akingbola *et al.,* 2014). People all across the world are affected by the disease, mainly in India, Sub-Saharan Africa, the Mediterranean and Southern European countries. The disease has also spread to the Caribbean, South and North America, and Northern Europe as a result of ancient and contemporary population migrations (Adegoke *et al.,* 2017). In Nigeria, according to the Federal Ministry of Health, (2005), data shows 25% of mortality in children below the age of 5 to be due to malaria, 30% of mortality in older children and 11% of maternal mortality.

A genetic disorder with great threats to tropical Africa is the Sickle cell disease. This disease condition has been reported to enhance the presence of malaria disease. As a result, a life - long blood disorder which is characterized by red blood cells having an abnormal but rigid, sickle shape with a risk of various complications is referred to as Sickle Cell Anaemia. The sickling occurs because of a mutation in the hemoglobin gene with age 42 and 48 years being life expectancy for males and females respectively (Platt, 2014). However, the African Americans and Africans have this disease most common among them.

Within the sickle red blood cells, the abnormal hemoglobin is found. This abnormal hemoglobin is also called hemoglobin S, having a sickle shape that is different morphologically from that of a healthy /red blood cell. Sickle cell anemia symptoms appear in babies as early as 4 months old. Sickle cell anemia, though with similar symptoms, still

vary in forms and including irritability, fatigue in excess, fussiness in babies, bedwetting, kidney related problems from associated kidney problems, such as jaundice, swollen and painful legs and hands among others (Emmanuel *et al*. 2015).

It has been suggested that haemoglobin S gene and malaria seems to be connected in a way, since they have similar geographic distributions being heterozygotes. The sickle cell gene confers substantial protection against clinical malaria (Ayi *et al.,* 2004; Mackenzie *et al.,* 2010). As sickle cell trait is predicted to reduce malaria admission rates by 70% and is 90% protective against severe and complicated malaria (Williams *et al.,* 2005). When parasite invasion reduces, there is delayed advance of *P. falciparum* in HbS erythrocytes at reduced oxygen tension, increased sickling and early senescence of phagocytosed erythrocytes and the development of antibodies to the band 3 protein; all of these are proposed mechanisms in which sickle cell gene protects against malaria (Kennedy 2010). It will therefore be significant to assess the prevalence, risk factors, of malaria among patients with and without sickle cell anemia in selected medical facilities in Lagos, Nigeria**.**

METHODOLOGY

Study Design

The study employs a retrospective cohort study based on hospital records, which were carried out at some health facilities in Ifako Ijaye, Alagbado Lagos state. The data for patients on admission from January 2017 to December 2020 were collected, collated and subjected to analysis.

Ethical Consent / Ethical Approval

Administrative approval was obtained from the management of the health facilities visited, after which the purpose of the study was communicated.

Study groups

Malaria disease was researched in individuals with Sickle Cell disease (SCD) and Non-Sickle Cell Anemia (nSCD). The age ranges of patients were 1 to 45 years old and they had a documented history of malaria disease.

Eligibility Criteria

Patients included in the study have been diagnosed with either type 1 or type 2 diabetes mellitus and are currently above the age of 19 during a 3-year period (January 1, 2018, to January 2, 2021). Criteria for exclusion were records of patients accessing health facilities for health services, other than type 1 or type 2 diabetes patients below age 19 and patients unwilling to participate in the study.

Study Procedure

The study group was recruited using hospital admission records, with the sociodemographic information linked with malaria fever in non-sickle cell disease and sickle cell disease patients extracted using record's entry form. Data validation and verification were carried out in order to eliminate duplication of records and to ensure that the data could be used for analysis. The information gathered was entered into a Microsoft Excel 2013 spreadsheet version and analyzed with the version 21 of Statistical Package for Social Sciences (SPSS) Software. The frequency distribution was determined using cross tabulation, and the association between variables was determined using the Analysis of Variance (ANOVA) with the significant level at 0.05.

RESULTS

Demography of Admitted Malaria Patients for the Study Period

The demography of patients admitted with malaria disease is presented in table 1. The results showed that a total of 24,599 (52.5%) of the patients were males while 22,267 (47.5%) were females. The age group shows that 23,043 (49.2%) of the patients were with age 1-10 years which was the highest percentage, followed by age 11-20 years which were 14,212 (30.3%). 9,497 (20.3%) of the patients were within age 21-30 years while patients within the age group of 31-40 years accounted for 89 (0.2%) with lowest percentage 25 (0.1%) accounting for age above 40.

The trend of malaria disease admitted from the year 2017-2020 presented in figure 1 revealed that 7,952 (17.0%) were admitted in 2017 and 10,874 (23.2%) were admitted in the year 2018; 9,890 (21.1%) were admitted in year 2019 while 18,150 (38.7%) which was the highest patient percentage was admitted in 2020. The trend of admission was significant across the years at $p<0.05$. In table 1, the percentage of admitted malaria patients shows that 44,708 (95.4%) of the patients are without sickle cell disease while 2,158 (4.6%) are battling with the blood disorder. Number of individuals with sickle cell disease were significantly different from the number of patience without sickle cell disease at $p<0.05$.

Table 1: Demography of Admitted Patients with Malaria Fever

Characteristics	**Frequency (%)**	**ANOVA**	
		F	**P value**
Gender			
Male	24,599 (52.5)	6.45	0.08
Female	22,267 (47.5)		
Age group (years)			
1-10	23,043 (49.2)	26.4	0.04*
11-20	14,212 (30.3)		
21-30	9,497 (20.3)		

31- 40	89 (0.2)		
> 40	25 (0.1)		
Admission Year			
2017	7,952 (17.0)	3.17	0.07
2018	10,874 (23.2)		
2019	9,890 (21.1)		
2020	18,150 (38.7)		
Sickle Cell Disease			
Yes	2,158 (4.6)	63.4	0.02*
No	44,708 (95.4)		

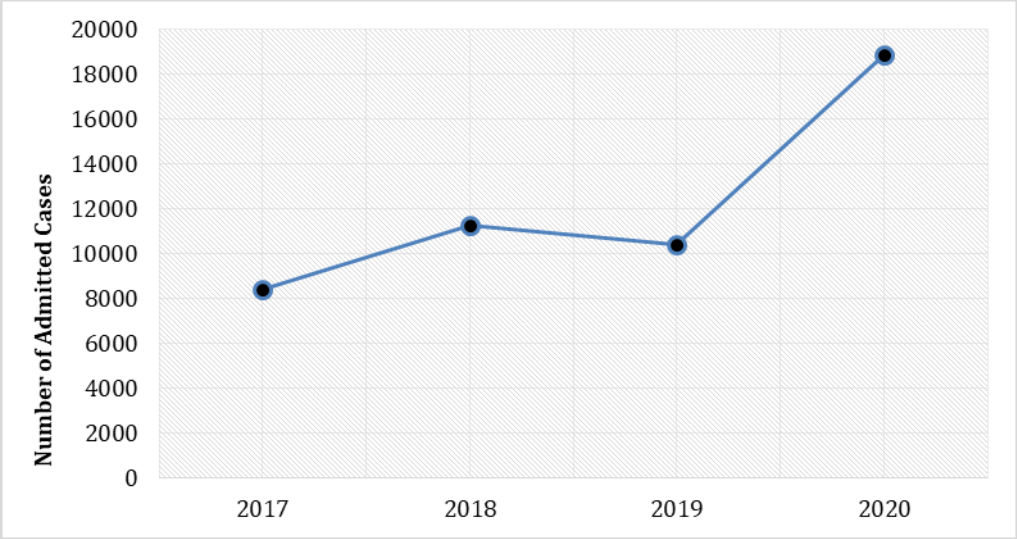

Figure 1: Trends of malaria disease cases from 2017 to 2020

Malaria Patients Mortality for the Study Period

Mortality status of patients with malaria disease are presented in Figure 2, the result showed that 59 (55.7%) of the patient were male while 47 (44.3%) were females. The age group shows that 91 (85.8%) of the patients were within age 1-10 year which was the highest mortality percentage while 15 (14.2%) were within age 11-20 years (Table 2).

The trend of malaria disease mortality from the year 2017 -2020 presented in figure 7.revealed that 18 (16.9%) mortality occurred in 2017, 28 (26.4) mortality occurred in 2018, 15 (14.2%) mortality occurred in 2019 while 45 (42.5%) mortality occurred in 2020. In Table 2, the percentage of mortality shows that 83 (78.3%) of the patients are without sickle cell disease while 23 (21.7%) are battling with the blood disorder. Mortality status was significant across the years at $p<0.05$.

Table 2: Mortality status of patients with malaria disease

Characteristics	Mortality (%)	ANOVA	
		F	P value
Gender			
Male	59 (55.7)	6.02	0.13
Female	47 (44.3)		
Age group (years)			
1-10	91 (85.8)	10.6	0.04*
11-20	15 (14.2)		
21-30	-		
31- 40	-		
> 40	-		
Admission Year			
2017	18 (16.9)	3.68	0.06
2018	28 (26.4)		
2019	15 (14.2)		
2020	45 (42.5)		
Sickle Cell Disease			
Yes	83 (78.3)	9.30	0.04*
No	23 (21.7)		

*Value asterisked are significant at $p < 0.05$

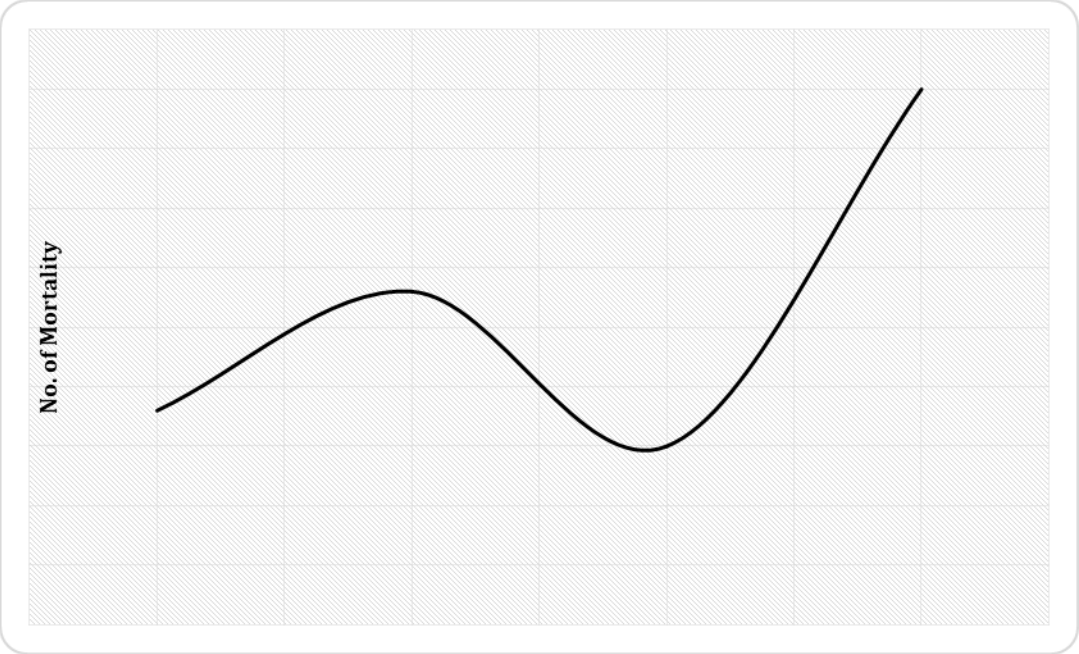

Figure 2: Trend of mortality across the years

DISCUSSION

The majority of the admitted patients in the study were males which are 52.5% of the total population. This finding corroborates the study by Aloni *et al.,* (2013) who reported male admitted patient to be 58.9%. Also Lagunju and Brown (2013) reported male to be 61.2% in ratio 1.6: 1 of the population of a study in Democratic Republic of Congo and Nigeria respectively. This shows that males and females should equally partake in prevention programmes. The largest age group of patients where young ones spanning from 1-20 years of age which are 79.5% of the total population. This is justified since children in sub-Saharan Africa are apparently at increased risk of malaria morbidity and mortality (Eleonore *et al.,* 2020). There was a significant increased cases of malaria disease (17% - 38.7%) from years 2017 to 2020. This could be so, as Nigeria has been known for high prevalence of malaria which represents 25% of global burden (Diallo *et al.,* 2019) and more so an exposure to mosquito bite through various lifestyle such as non-use of the mosquito treated net,

insecticide and available control measures. A significant minority of the admitted malaria patients (4.6%) were suffering from the sickle cell disease. This finding corroborates the work by Eleonore *et al.* (2020) who reported a sickle cell disease case of 22% compared to some non-sickle cell disease patients in a study from Cameroon.

According to the World global health day organized by the World Health Organization (2018), it was reported that in the African continent, especially the sub-Saharan Africa, malaria diseases are responsible for child mortality every two minutes. A total of 106 mortality cases was recorded, out of which the majority were male 55.7%. The mortality from a malaria disease in the study take the pattern similar to that of the admitted malaria cases, i.e., a significant increase from 16.9% to 42.5% from 2017 to 2020 respectively. The obvious increase in mortality in the year 2020 could be traced to various reasons such as the global pandemic which could to a sluggish attention to illness, complication in patients. The children within the age group of 1-10 experienced majority of the mortality (8.58%), this is in strong agreement with the report of the W.H.O (2018) and Eleonore *et al.* (2020). According to Tshilolo *et al.,* (2007) the leading cause of sickle cell morbidity has been severe malaria. However, from this study 21.7% of the mortality cases are suffering from sickle cell disease, this is significant in proportion to the mortality case of those without sickle cell disease. It is an established phenomenon that malaria disease worsens that case of haemolytic anaemia in sickle cell disease patients.

Conclusion

The result from the study it can be confirmed that children are the most vulnerable human population to malaria disease, this however include both the male and female indicating that they both needs preventive measures. Patients with sickle cell aneamia were recorded to be

minor in the admitted malaria cases but significant in the mortality proportion to those without sickle cell disease.

Recommendation

Based on the outcome of the study, larger numbers of hospital should be employed in order to obtain a more comprehensive detail. More so, the high susceptibility of sickle cell patients to malaria fever should be communicated to the general public so as to ensure prevention against mosquito bite.

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