Identification of Major Subclinical Symptoms of Malaria among Carriers in Owerri, Nigeria

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Abstract:

Malaria remains a life-threatening disease with significant public health implications, especially in Sub-Saharan Africa. Malaria can be detected early, which can lead to earlier care and a reduction in morbidity and disease burden. Researchers in Owerri, Nigeria, decided to learn more about subclinical malaria symptoms. The study took place in two communities: Naze and Ikenegbu, both of which are suburbs of Owerri metropolis, between September and December. Using a home, systematic sampling process, 468 people were drawn for the study from both locations, with males 196 (41.9%) and females 272 (58.1%) meeting the inclusion criteria. A positive microscopy result for the malaria parasite was needed for inclusion, but there were no typical clinical symptoms. Later, the participants were given Artemether Lumefantrine. The most common symptoms of subclinical malaria reported by the participants were body itching (444, 94.9 percent), bone pain (440, 94.0 percent), sleepiness (440, 94.0 percent), bad dreams (428, 91.4 percent), and dizziness (440, 94.0 percent). 368 (78.6%), bitter/sour taste 360 (76.9%), joints/muscular pains 308 (65.8%), and body exhaustion 300 are the most common complaints (64.1 percent). The most common signs are cough/catarrh, 92 (2.7 percent), and stomach pain, 92 (2.7 percent) (19.7 percent), yellow urine (6.0 percent), constipation (6.0 percent), and sleeplessness (20 percent) (4.3 percent). The numbers observed increased as a result of the fact that many people identified more than one symptom. These subclinical symptoms increase the risk of impending malaria attacks, causing patients to seek prompt diagnosis and treatment. Artemether-lumefantrine started in the subclinical stage had a better treatment outcome than artemether-lumefantrine started in the clinical stage, when the most debilitating features of the malaria attack surface, according to a recent study in the same research region. Malaria could be reduced in morbidity, mortality, and socioeconomic burden if it is detected and treated early.

Key words: Subclinical symptoms, malaria, Southeast Nigeria.

1. INTRODUCTION

Despite significant progress in reducing the number of malaria cases and deaths worldwide, malaria remains a life-threatening disease with significant public health implications in the world today, especially in Sub-Saharan Africa. According to the World Health Organization's (WHO) most recent global survey, there were 214 million cases of malaria in 2015, 438,000 deaths worldwide, and about 3.2 billion people – almost half of the world's population – were at risk of malaria in 2015.

Malaria is caused by the infestation of red blood cells with protozoan parasites of the genus plasmodium inoculated into the human host by a feeding female anopheline mosquito. The four

human Plasmodium species transmitted from person to person are *P. falciparum, P. vivax, P. ovale*, and *P. malaria*. Increasingly human infestations with the monkey malaria parasite, *P. knowlesi* are being reported from the forested region of South-East Asia and particularly the Island of Borneo

The classic symptom of malaria is paroxysm—a cyclical occurrence of sudden coldness followed by shivering and then fever and sweating, occurring every two days (tertian fever) in *P. vivax and P. ovale* infections, and every three days (quartan fever) for *P. malariae. P. falciparum* infection can cause recurrent fever every 36–48 hours, or a less pronounced and almost continuous fever

At the subclinical stage of the disease, there are initial manifestations that are common to all malaria species and are similar to flu-like symptoms. These symptoms are non-specific and can resemble other conditions such as sepsis, gastroenteritis, and viral diseases. They comprise lassitude, fatigue, abdominal discomfort, and muscle and joint aches. Others may include bone pain, bad dreams, bitter taste, retrograde amnesia, hypothermia, pruritus on cold bath, and restlessness. The later presentation may include headache, fever, shivering, joint pain, vomiting, and hemolytic anemia, and jaundice, hemoglobin in the urine, retinal damage, and convulsions

In a study to investigate where a key stage of the lifecycle of malaria parasite takes place Joice *et al* looked at tissue samples from autopsies of children who had died from malaria. This interesting study found evidence of the likelihood that the sexual reproductive stage in the lifecycle of *Plasmodium falciparum* takes place outside of the blood vessels, in the bone marrow. It has also shown that these immature gametocytes are rarely destroyed by the immune system and this might explain the manifestation of bone pains at the subclinical stage of the disease.

In the study area, a literature search could not show any study that has been done to establish some of these symptoms. Identification and establishment of the symptoms and signs which present at the early stage of the disease can serve as warning signals and thus help the patient to seek medical diagnosis and treatment quite early. These can as well raise the index of suspicion of the medical personnel aiding early management of malaria. Treatment at this early stage of the disease when it is little or no organ dysfunction usually leads to full recovery and stalls progression to lethal severe malaria especially in the case of *P. falciparum*.

Consequently, the burden of malaria can be minimized by a reduction in mortality and morbidity rate, reduction in the direct and indirect cost of treatment of malaria. A recent study done in the same study area showed a better treatment outcome with artemether-Lumefantrine initiated at the subclinical stage than during the clinical stage. Therefore, this study aimed at establishing some of the major symptoms associated with subclinical malaria in Owerri, South Eastern Nigeria.

2. MATERIALS AND METHOD

2.1 STUDY AREA

Owerri is Nigeria's administrative capital of the state of Imo. It is also the largest state city, the second and third being followed by Orlu and Okigwe. Owerri consists of three Local Government Areas, namely Municipal Owerri, North Owerri and West Owerri, with co-ordinates 5^0 4 8 5^0N 7^0 3 5^0 N. As of 2016, the population is estimated to be about 1,401,873 and the town is about 100 square kilometers (40 sq mi). Owerri is bordered by the Otamiri River to the east and the Nworie River to the south. To represent semi-urban and urban areas, respectively, Naze and Ikenegbu were selected. The normal temperature is 26.4^0C, whereas the average precipitation is 2,219 mm. For the rainy season (April to September) and for the dry season (October to March), the annual rainfall is 214 to 220 cm. It is a malaria-endemic area, with other species predominating in *P.*falciparum

2.2 STUDY POPULATION AND SAMPLING

The study population consisted of males and females aged 18 years and above who were living in the study areas at the period of study. The study lasted for 4 months. After thorough house mapping and numbering of houses in these communities, a systematic house-to-house sampling technique was employed in the selection of the participants who fulfilled the inclusion criteria.

The inclusion criteria were; subjects that claimed they can recognize subclinical malaria symptoms and confirmed they had the symptoms at the time of the survey and who tested positive for *Plasmodium falciparum* malaria detected by microscopy. Other criteria used for inclusion were the absence of clinical malaria symptoms or signs especially fever, headache, chills, or rigor; ability to swallow and tolerate the oral medication (Coartem); ability and willingness to give consent and to comply with the protocol for the duration of the study as well as comply with the study visit schedule. Also not included were subjects who treated malaria within two weeks before the study and/ or were pregnant/lactating mothers.

2.3 STUDY DESIGN AND DATA COLLECTION

This study utilized a community-based, interventional study in two different communities in Owerri, Southeastern Nigeria. A carefully prepared and face validated questionnaire was used to elicit information from participants. Screening of participants in the field was achieved using the questionnaire and the Carestat RDTs.

2.4 LABORATORY EXAMINATION AND SCREENNING

Carefully prepared slides were screened microscopically in the laboratory under x 100 oil immersion lens using a light microscope as a confirmatory test. Parasite density was determined with the thick films by counting the number of asexual parasites per 200 white blood cells (WBC) and calculated per µL. The absence of malaria parasite in 100 high power ocular fields of the thick film was considered as negative. Detection of the parasites species was done with thin films. Participants who had subclinical malaria were treated with Coartem by one of the researchers who are a medical doctor. The drugs were administered according to the manufacturer's recommendations, and they were subsequently followed up to ensure a full recovery.

2.5 DATA ANALYSIS

As the prevalence of subclinical malaria in the study area was yet unknown, prevalence was assumed at 50% (0.5). So using the formula: z^2x P (1-P)/$q^2$where z= 1.96 at 95% confidence interval, P (Prevalence of subclinical malaria in the study area) = 0.5, q (margin of error) at 5%= 0.05, n= $(1.96)^2$ x 0.5(1- 0.5) / 0.05^2 = 384. Consequently, a total of 468 participants were recruited from both sites (the urban and semi-urban communities).

2.6 ETHICAL CONSIDERATION

Ethical approval for this study was approved and obtained from the ethics committee of the Public Health Department, the Federal University of Technology Owerri School of Health (FUTO) and the Federal Medical Center (FMC) (Protocol No. 9789). The participants were informed of the goals, told of the confidentiality of the study and when they agreed to take part in the study, and were asked to sign an agreement of informed written consent and a follow-up case form.

RESULTS

Sociodemographic Characteristics of Participants:

A total of 468 participants were recruited for the study, 204 (43.6%) from the suburban community (Naze), 264 (56.4%) from the urban community (Ikenegbu) in Owerri Imo State Nigeria. One hundred and ninety-six (41.9%) of them were male while 272 (58.1%) were female (Table 1).

Out of the 468 participants, 168 (35.9%) were between the ages of 18-22, 52 (11.1%) between 23-27

years of age, 76 (16.2%) between 28-32years while 52(11.1%), 24(5.1%) and 96 (20.5%) were between the ages of 33-37, 38-42 and ≥43 years respectively (Table 1). The mean age was 32 years in both study areas.

In the area of occupation of the participants, the majority, 34(29.1%) were students, 30(25.6%) were civil/public servants, 30(25.6%) were businessmen/women whereas 19(16.2%) and 4(3.4%) were farmers and unemployed respectively. At the suburban study community (Naze), the majority of the participants, 68 (33.3%) were farmers while at Ikenegbu (urban community), the majority of the participants, 88 (33.3%) were businessmen or women (Table 1)

Major Subclinical Malaria Symptoms Reported by Participants in Owerri, Imo State

The major symptoms of subclinical malaria reported by the participants from both study sites included body itching, 444 (94.9%), bone pains and sleeplessness, 440 (94.6%) each, 440 (12.8%), bad dreams, 428 (91.4), dizziness, 368 (78.6%), bitter/sour taste, 360 (76.9%), joints/muscular pains, 308 (65.8%), and weakness of the body, 300 (64.1). Others reported were cough/catarrh, abdominal discomfort, and loss of appetite, all of which were 92 (19.7%) each, yellow urine, 28 (6.0%), constipation, 28 (6.0%), and sleeplessness, 20 (4.3%) (Table2).

At the suburban community of study (Naze), the order of frequency of the major symptoms of clinical malaria varied with bad dreams topping the others, 196 (96.1%), followed by sleepiness and body itching, 192 (94.1%) each, bone pain, 184 (90.2%), bitter/sour taste, 172 (84.3%), joint/muscular pain, 124 (60.8%), weakness of the body, 88 (43.%) and others, 144 (70.2%). At Ikenegbu (the urban community of study), bone pain was highest, 256 (96.7%), followed by body itching, 252 (95.5%), sleepiness, 248 (93.9%), bad dreams, 232 (87.9%), dizziness, 220 (83.3%), weakness of the body, 212 (80%), bitter/sour taste, 188 (71.2%), joint/muscular pain, 184 (69.7%), and others 208 (78.8%) (Table 2)

Table 1: Sociodemographic Characteristics of Participants

Variables	Naze No. (%)	Ikenegbu No. (%)	Total No. (%)
Sex			
Male	104(51.0)	92(34.8)	196(41.9)
Female	100(49.0)	172(63.2)	272(58.1)
Total	204(100.0)	264(100.0)	468(100.0)
Age			
18- 22	68 (33.3)	100(37.9)	168(35.9)
23-27	20(9.8)	32(12.1)	52(11.1)
28-32	24(11.8)	52(19.7)	76(16.2)
33-37	16(7.8)	36(13.6)	52(11.1)
38-42	12(5.9)	12(4.5)	24(5.1)
≥43	64(31.4)	32(12.1)	96(20.5)
Total	204(100.0)	264(100.0)	468(100.0)
Occupation			
Civil/Public Service	36(17.6)	84(31.8)	120(25.6)
Business	32(15.7)	88(33.3)	120(25.6)
Studying	56(27.5)	80(30.3)	136(29.1)
Farming	68(33.3)	8(3.0)	76(16.2)
Unemployed	12(5.9)	4(1.5)	16(3.4)
Total	204(100.0)	264(100)	468(100.0)
Location	51(43.6) **N**	66(56.4) **I**	117(100.0)

Table 2: Major Symptoms of Subclinical Malaria Enlisted by 468 Participants In Owerri Imo State

Major Symptoms of Subclinical Malaria	Locations		
	Naze No.(%)	Ikenegbu No.(%)	Total No.(%)
Bone pain	184(90.2)	256 (96.7)	440 (94.0)
Joint/muscular pains	124(41.1)	184(69.7)	308 (65.8)
Body Weakness	88(41.3)	212(80.3)	300(64.1)
Bad dreams	196(96.1)	232(87.8)	428(91.4)
Dizziness	148(74.0)	220(83.3)	368(78.6)
Bitter/sour taste	172(84.3)	188(71.2)	360(76.9)
Sleepiness	192(94.1)	248(93.9)	440(94.0)
Body itching	192(94.1)	252(95.5)	444(94.9)
Cough/catarrh,	30(14.7)	62(23.5	92 (19.7)
Abdominal	42(22.8)	50(19.5)	92 (19.7)
discomfort	37(18.1)	55(20.8)	92 (19.7)
Loss of appetite,	17 (8.2)	11(4.2)	28 (6.0)
Yellow urine	13(6.4)	15(5.7)	28 (6.0)
	9(4.4)	11(4.2)	20 (4.3)
Constipation			
Sleeplessness			

N.B. *There were multiple responses from participants; some indicated more than one subclinical symptom.*

Discussion:

The major symptoms of subclinical malaria established from this study in decreasing order of frequency included body itching, bone pains, sleepiness, bad dreams, dizziness, bitter/sour taste, joints/muscular pains, and weakness of the body. Few others reported constipation, abdominal discomfort, and loss of appetite, yellow urine, cough/catarrh, and sleeplessness. This was similar to earlier findings which had identified some of the above-mentioned symptoms (weakness of the body, abdominal discomfort, Muscular/joint pains) and bone pains to occur at the early stage of malaria. Others like bad dreams, dizziness, and bitter/sour taste, and sleepiness, sleeplessness have thus been established by this study.

These symptoms create suspicion of impending malaria attacks among individuals. Information deduced from the participants showed that many of them could predict subclinical malaria disease following the experience of these symptoms. This could cause them to take further actions towards proper diagnosis and treatment at the early stage.

At this early stage of disease progression, with mild or no vital organ dysfunction, a rapid, full recovery is expected, provided prompt, effective antimalarial treatment is given. If ineffective or poor quality medicines are given or if treatment is delayed, particularly in *P. falciparum* malaria, the parasite burden often continues to increase and the patient may develop potentially lethal severe malaria. Symptoms like yellowing of urine and weakness of body become more pronounced in clinical cases when the fever had already set in and breaking off more blood cells by the parasite becomes pronounced leading to clogging of blood vessels by antigen/antibody complexes.

Early detection and treatment of malaria have been known not only to prevent progression to severe form of malaria but also to reduce morbidity and mortality and burden of disease in terms of cost of treatment and prolonged hospital stay as well as absenteeism from work/school. Also, the subclinical symptoms established in this study will raise a high index of suspicion among medical personnel as these patients present to them for diagnosis and treatment.

The study was able to establish some more symptoms associated with subclinical malaria in the study sites which included; body itching, bone pain, sleepiness, bad dreams, and bitter/sour taste. These symptoms serve as alert to both patients and medical personnel prompting them towards early diagnosis and proper treatment which in turn will reduce the morbidity and mortality rates of malaria in affected areas.

Acknowledgments

Conflicts of Interest

The author hereby declares that he has no conflict of interest.

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