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Emerging Buruli Ulcer Infection and Cultural Beliefs among the Tiv People in North-Central Nigeria

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ABSTRACT

Buruli ulcer is a public health concern particularly where the knowledge about the disease is poor. An advent of an emerging wound ulcer epidemic was reported in North-central Nigeria in 2023. A study was then carried out between December 2023 to August 2024 to determine the prevalence and the knowledge about the infection among the Tiv people of North-central Nigeria who had reported the emerging strange wound ulcer disease. Descriptive epidemiological survey was conducted to determine the prevalence and the causative agent of the emerging wound ulcer. Wound swabs were taken from the ulcers for laboratory confirmation that these infections were indeed those caused by Mycobacterium ulcerans. Of the 1,030 people assessed (392) 38.09 % presented with the wound ulcer, confirmed to be Buruli ulcer caused by *M. ulcerans* infection (p>0.05). This infection cuts across all ages, occupation, gender, even educational levels and occupations. Traditional (88.6%) and spiritual (59.4%) means of infection were the dominant means by which the people believed the infection can be acquired. Mycobacterium ulcerans infection (Buruli ulcer) is highly prevalent and fast emerging among the Tiv people of North-central Nigeria. The knowledge about mode of infection and its means of spread is limited and very poor. There is the need for health authorities to intervene, mount health awareness campaigns on the disease, its mode of spread, prevention and control, to ameliorate the sufferings of these people and restore confidence among them. This will help to curb further spread of the infection.

Keywords: emerging, Buruli ulcer, traditional beliefs, ignorance, Nigeria.

INTRODUCTION

Buruli ulcer was first reported in patients from Buruli County in Uganda, and the causative organism was first isolated in 1948 by MacCallum in the Bairnsdale region of Victoria, Australia, then in 1998, the WHO classified Buruli ulcer as a neglected emerging infectious disease ¹. This disease is caused by a bacterium called *Mycobacterium ulcerans*, and like *Dracunculus medinensis*, this bacterium produces a toxin that causes the skin damage that subsequently creates the wound ulcer. Without early treatment, Buruli ulcer can lead to long-term disability ². It has been reported that the bacterium that causes Buruli ulcer belongs to the same family of those that cause tuberculosis and leprosy. It is still unclear how people get Buruli ulcer from the environment ³. The mode of transmission remains obscure to this day, although several hypotheses have been proposed. Many authors have discussed potential reservoirs as well as vectors and transmission mechanisms that vary from region to region depending on the epidemiological, social and local environmental context. Direct human to human transmission of *M. ulcerans* is a rare possibility ⁴. The main hypothesis is that the surface of the patient's skin was contaminated by bacteria from an environmental source (e.g. swamps) and introduced into the skin by trauma. It is assumed that insects (aquatic bugs and mosquitoes) are the host and vector of M. ulcerans. Several experimental and environmental studies have demonstrated the implication of aquatic bugs in transmission of the disease ⁴. There are currently no known primary preventive measures for Buruli ulcer and the mode of transmission has not been established ⁴. Presently, there is no drug of choice for the treatment of Buruli ulcer, however, present management consists of a combination of antibiotics and complementary treatments ⁵. Interventions such as wound and lymphedema management and surgery (mainly debridement and skin grafting) are used to speed up healing, thereby shortening the duration of hospitalization. Physiotherapy is needed in severe cases to prevent disability. Patients left with disability require rehabilitation. These long-term same interventions are applicable to other neglected tropical diseases, such as leprosy and lymphatic filariasis ⁵.

World Health Organization (WHO) classifies Buruli ulcer lesions into three categories according to severity ^{4,5,6}. Category I lesions are single small lesions (e.g. nodules, papules, plaques and ulcers < 5 cm in diameter). Category II lesions consist of non-ulcerative or ulcerative plaques, edematous forms and single large ulcerative lesions of 5–15 cm in cross-sectional diameter, while lesions in the head and neck regions and the face, disseminated and mixed forms including osteomyelitis, and extensive lesions of more than 15 cm are considered as Category III.

The infection **is** characterized by the development of painless open wounds and it is limited to certain areas of the world, with most cases occurring in Sub-Saharan Africa and Australia. Descriptively, the first sign of infection is a small painless swelling, typically on the arms or legs. This grows larger over days to weeks, eventually forming an open ulcer sometimes resulting in permanent disability ⁷.

Buruli ulcer has been reported in over 33 countries in Africa, the Americas, Asia and the Western Pacific. Most cases occur in tropical and subtropical regions except in Australia and Japan. Out of these over 33 countries, 14 regularly report data to WHO ^{7,8} and the status of this disease in the other 19 countries remain unknown, these are mostly countries from African continent. The disease is widespread in West and Central Africa, French Guiana and much of South America, and Australia, and most of the burden of the disease falls on West and Central Africa ⁹, with the majority of cases being in Cote d'Ivoire. In the available epidemiological data, Nigeria presents a notable gap in cases, surrounding countries such as Cameroon and Benin Republic which have highly endemic regions, and this gap is likely due to underreporting and the lack of adequate public health structures ¹⁰.

Buruli ulcer was first described in Nigeria in 4 patients living in Benue State in 1967 and in 1976 a total of 24 Buruli ulcer patients were described in an area around Ibadan, Oyo State ¹¹. Thirty years later the Nigerian government, with the support of the WHO, conducted an assessment of Buruli ulcer presence in the Southern and Southeastern states of the country where cases had been previously reported. As a result of that study, 14 patients were considered likely to have a Buruli ulcer, and came from 5 different states: Anambra, Cross River, Enugu, Ebonyi and Akwa Ibom¹². Most recently, the presence of Buruli ulcer in Nigeria was mentioned in a study in which nine M. ulcerans strains were isolated from patients living in Oyo, Anambra, Cross river Enugu, Ebonyi or Ogun States, between year 2006 and 2012^{12,13,14}. In total, 51 Buruli ulcer patients were described in 45 years, all found in Southern Nigeria. This region is characterized by a tropical rainforest climate, similar to Buruli ulcer endemic areas around the Gulf of Guinea. The Northern part of the Nigeria is associated with a tropical dry climate which is not known to be associated with Buruli ulcer presence.

Recently, there has been palpable fear about a characteristic wound ulcer rampantly emerging among the community dwellers in North-central Nigeria. This infection is unknown to these people and they have quickly given the new infection a descriptive traditional name-' Ambi' based on its mode of spread and the burden it creates when infected. Permanent disabilities were soon observed among these people who were infected and by their traditional means of treatment were partially healed but will soon reappear and ultimately resulting in deaths. The fear of this infection and its cosmopolitan nature coupled

with the limited knowledge about the infection compounded by the traditional believes have made the management of this infection difficult, hence causing and emerging epidemiological concern. Therefore, we designed this study to determine the prevalence of this emerging infection among the Tiv people of North-central Nigeria and then assessed their knowledge concerning this emerging infection.

MATERIALS AND METHODS

The study area and the population

The Tiv people in North central Nigeria constitute over 16 million people in population ¹⁵ spanning 7 states of Benue, Nasarawa, Taraba, Adamawa, Kogi, Kwara, Niger and Abuja (the Federal Capital City). They are the 5th largest ethnic group in Nigeria coming only after Hausa, Yoruba, Igbo and Ijaw. Predominantly they are found in Benue State where they constitute about 90% of the population of the State. The population are mainly farmers; hence the State is called 'the food basket of the nation'. This study was carried out among this population with a particular interest in Benue State.

Study design

This was a community-based cross-sectional survey (Descriptive epidemiological survey) carried out between December 2023 to August 2024. It was conducted in two phases: a preparatory, and a case-finding phase. During the first three to four weeks of the project, advocacy visits were held with all the community leaders and health authorities, and their approval for the study was obtained. Field staff members were trained on identification of Buruli ulcer suspects, sample collection, preparation and transportation. General health workers working in the primary health facilities in the study area were trained on Buruli ulcer symptoms recognition at the earliest. The case-finding phase involved intensive communication advocacy, and social mobilization. Outreach/sensitization activities took the form of village hall/square meetings with the whole community at a time. Community leaders were informed of the intention to hold outreach programs in their communities, an agreeable date was chosen for the event, community members were instructed to gather at the village hall/square, and finally the community

sensitization program was undertaken. This was followed by a door-to-door visit where detailed information about Buruli ulcer was obtained. Case-finding formed part of the advocacy, communication and social mobilization activities. In addition, traditional healers in each community interviewed about management of were individuals with chronic ulcers and their general knowledge about the disease. All other procedures were done as described by Bratschi et al ¹⁶ where place and persons of particular time. characteristics (in this case conspicuous wound ulcers) were assessed.

Ethical clearance

Ethical approval for this study was obtained from the Ethical Review Committee of the Benue State Ministry of Health with reference number ERC/MOH/024/018.

Informed consent

Consent was first obtained from the traditional heads in the various communities to gain access to their respective communities. This followed by the individual consent for each subject willing to participate in the study. All subjects who were willing to be recruited for this study were assured of the confidentialities of their personal information and accruable benefits of the research work to them as well as the community at large. Only people who were willing and volunteered participated in the study.

Variables

Epidemiological variables like age, gender, community of residence, occupation and level of education were obtained.

Sample size determination

The sample size was determined using Fisher's formula ¹⁷ and an overall sample size of One thousand and thirty (1,030) individuals were examined for knowledge about Buruli ulcer. It was calculated based on the reported prevalence (87.8%) by Kingsley et al, 2016 in their paper on 'Buruli ulcer in Nigeria: results of a pilot case study in three rural districts' ¹⁸.

Sampling technique

In this study, the non-probability sampling technique was used where sampling was not based on any known probability. Identification of the infection was based on the characteristics visible ulcer seen on the bodies of the patients in the communities.

Sample collection

Structured questionnaires were administered on each subject and socio-demographic data of the subjects, address, State, local government area, profession/occupation were provided. For subjects with wound ulcer, a tag number was given on the questionnaire to correspond with the swab specimen collected so as to ensure that each specimen corresponds with the given information.

Laboratory data collection and processing

Samples were collected by swabbing the entire undermined edge of the ulcer with a sterile swab sticks. The sample was used to prepare a smear which was taken to the Microbiology diagnostic laboratory of the University of Ilorin Teaching Hospital for Ziehl -Neelsen staining. Direct smears examinations were prepared using materials like; a pencil to label the slides from the swabs, adding 2 ml of phosphate-buffered saline in the vortex wells, then the smear was prepared by the suspension of the labeled slide, air-dried and heat-fixed by passing the slide through a flame three times as described by the laboratory diagnosis of Buruli ulcer-edited by Huang et al 19 and confirmed by the Laboratory Confirmation of Clinical Buruli ulcer disease by laboratory testing (microscopy) using the WHO guidelines ²⁰. These laboratory procedures were done primarily to confirm that all the wound ulcers seen were indeed those caused by Mycobacterium ulcerans.

Statistical analysis

The data were recorded on a standardized Buruli ulcer Report Form, double-entered into a Microsoft Excel (Microsoft Office Inc for Windows, USA) database and analyzed using the statistical packages for social sciences (SPSS version 24.00). Continuous variables were summarized and categorical variables as counts and percentages. The Fisher's exact or chi-square test was used to compare categorical proportions, and the Student's *t*-test was used in the case of continuous variables. The significance level was set at 95 %, (p-value at 0.05).

RESULTS

Table 1 shows a significant prevalence of Buruli ulcer infection (38.06%) among people in the study area. The highest prevalence of 53.6% was seen in the age group 40-49 while the least prevalence of 3.1% was observed among the age group of 50-59 years. On gender, more males (42.9%) were significantly infected than the females (26.2%) p<0.05. And on educational status, people with secondary school as their highest level of education had a prevalence of 41.3% followed by those with non-formal education (40.2%) and then 25.0% for those with higher educational background. Infection among professional affiliations showed that the civil servants had an infection rate of 40.4% followed by 36.6% from farmers. On knowledge of this infection, only 1.6% have ever heard about the infection among people in the community and 8 (47.1%) among them had the infection. The 98.2% of all the people examined had no knowledge of this infection before and among this group, 384(38.0%) have had the infection. Only about 0.2% of the population studied remain indifferent about the disease. Knowledge on the mode of infection showed that 913 (88.6%) believed that the infection is acquired through traditional means and 612 (59.4%) believed it is acquired through spiritual means. About 4.2% of the people believed the source is through contaminated water, while 11.0% and 2.1% believed it was through soil and insect bite respectively.

Parameters		Number= n (%)	Number (%)
		Examined	infected
	20-29	263(25.5)	52(19.8)
	30-39	335(32.5)	171(51.0)
Age	40-49	302(29.4)	162(53.6)
	50-59	130(12.6)	04(3.1)
	Total	1030(100.0)	392 (38.06)
	P<0.05		
	Male	732(71.1)	314(42.9)
Gender	Female	298(28.9)	78(26.2)
	Total	1030(100.0)	392 (38.06)
			P< 0.05
	Tertiary	176(17.1)	44(25.0)
Education	Secondary	416(40.4)	172(41.3)
	Non-formal	438(42.5)	176(40.2)
	Total	1030(100.0)	392 (38.06)
	Civil Service	399(38.7)	161(40.4)
Profession	Farming	631(61.3)	231(36.6)
	Total	1030(100.0)	392 (38.06)
	Yes I heard about the	17(1.6)	8(47.1)
	infection before now		
Knowledge about	No, I did not hear about the	1011(98.2)	384(38.0)
the infection	infection in my life		
	Indifference/no clue	02(0.2)	0(0.0)
	Total	1030(100.0)	392 (38.06)
	Spiritual Means	612(59.4)	351(57.4)
	Traditionally infected	913(88.6)	392 (42.9)
*How is the	Through water contact	43(4.2)	34(79.1)
infection gotten to	Gotten from the soil	113(11.0)	109(96.5)
man	Through insect bite	22(2.1)	13(59.1)
	Lover leg (foot, ankle,		
	shin to the knee)243	Upper leg (Upper knee,	Arm (hand, wrist to
	(62.0)	thigh to hip) 112(28.6)	shoulder)
Ulcer Locations			37(9.4)

Table1. Prevalence of and knowledge about Buruli ulcer (*Mycobacterium ulcerans* infection)⁻Ambi among the Tiv people in North-central Nigeria-N=1030, in 113 Communities/Settlements/Enclaves

*Mean multiple responses; P<0.05=significant infection among the population

% examined =number= examined /N; % infected =number infected /n

Figure 1 shows some pictorials of the anatomical depletions by the wound ulcer and all the people who were termed positive from this infection as studied were those with open wound ulcer as seen in fig 1. Confirmation that these infections were that of Mycobacterium ulcerans infection were done only when wound swabs identified the bacterium in a simply laboratory procedure as described. Ulcer Locations were seen to be 62% from the lower part of the leg, 28.6% on the upper part of the leg and 9.4% on the hand.



Figure 1: Photomicrographs of *Mycobacterium ulcerans* infections in the study area showing the Anatomical depletions of the legs of the infected persons caused by the wound ulcers by the infection.

DISCUSSION

The 38.06% prevalence of Buruli ulcer infection observed in North-central Nigeria is very significant in communities around the northcentral region of the country, particularly for an infection with unknown origin, mode of spread, management, prevention and whose control measures are not clear. This study showed that this infection has presented emerging an epidemiological concern in Nigeria like Lassa fever and cholera outbreaks. In our study, the middle age group of 40-49 years had the highest prevalence of 53.6% closely followed by 30-39 years age group with 51.8% prevalence, showing a slight departure from other findings ^{6.9.11} which reported highest prevalence among the aged. This finding is however not a wide departure from other works ¹¹, as we observed the progression from 51.0% to 53.1% prevalence from 30-39 and 40-49 age group respectively, even though we reported a low prevalence of 3.1% between age 50-59. Like others 13,14 , the high prevalence of this infection among the males is an indication that this infection may have some resemblance with some activities in the communities but also not necessarily considering the female/male gender issue. Moreover, the infection was considerably found in the female population (26.2%). From this finding, we can say that although more males were infected than females, this infection may not necessarily mean that it is gender bias.

From our findings, educational status of the study population and professional affiliations had no influence on the infection. The educated as well as the uneducated show similar infection rates. Even though there was no significant difference in the infection rate among the professional affiliations, the high prevalence recorded among the civil servants (40.4%) compared to the farmers (36.6%) further affirms the gravity of this infection across all professions. Although it has been previously reported that this infection is mostly found in swampy areas ^{18,19, 20, 21}, findings from our study did not clearly demonstrate this. Thus, the infection has not shown any particular pattern as it relates with water or soil contacts; both farmers and the civil servants do engage in almost the same kind of activities in the communities, hence the wide spread nature of this infection.

There were signs of secondary bacterial infections on the wounds, characterized by redness of the wound ulcers particularly where infected people result to self-help with the belief that this infection cannot be treated in hospitals. The traditional means of management have rather compounded situations particularly when leaves were grinded and used to cover the wounds. Another interesting scenario was observed in these communities when over 30% of the infected population was seen in hideouts. When interviewed, they were afraid of stigmatization about the disease while other felt it was the only way they could shield other family members from acquiring the infection.

Knowledge and understanding about this infection still remains poor. People generally believe that the infection is acquired through traditional or spiritual means coupled with the fact that the behavior of the wound differ significantly from all known wounds and the traditional means of treating normal wounds in their communities. It is obvious from our study that people in these communities lack adequate knowledge of this infection and how it can be contracted. Hence the need for relevant authorities to educate people about the disease. Otherwise, as the disease spreads, the beliefs will also spread along, with devastating consequences. Meanwhile, these beliefs are not shared in other communities across the globe 21 .

In most Neglected Tropical Diseases (NTDs) like onchocerciasis, dracunculiasis and schistosomiasis, traditional beliefs, poverty and ignorance have been the major factors militating against the smooth flow of control/eradication efforts among people in many developing countries ^{22, 23}. If measures are not effectively developed to curb this emerging Buruli ulcer infection in communities in our continent, it could end up as other NTDs.

Conclusion

Buruli ulcer is an emerging infection in the study population and the knowledge of this disease, its mode of infection and spread, its management and control are very poor and highly limited. We recommend that necessary measures should be put in place by relevant health authorities to halt the spread of the infection and ameliorate the suffering of the people from this emerging public health problem.

Limitation

This study relies only on microscopy thus a more advanced PCR diagnosis is needed in other studies.

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Conflict of interests

We declare that there is no any conflict of interest.

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