Original Research

Emerging Buruli Ulcer (*Mycobacterium ulcerans* infection)-Ambi among the Tiv People in North-Central Nigeria: A Public Health Concern Compounded by Traditional Believes and Ignorance

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Abstract

Background: Buruli ulcer is of public health concern particularly where the knowledge about the disease, the infectious agent, treatment and control 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 20204 among the Tiv people of North-central Nigeria who have reported an emerging strange wound ulcer disease among her population. We determined the prevalence and the knowledge about the infection among this population.

Methods: Descriptive epidemiological survey was conducted to determine the prevalence and the causative agent of the emerging wound ulcer among the Tiv people. Wound swabs were taken from the ulcers for laboratory confirmation that these infections were indeed those caused by *Mycobacterium ulcerans*.

Results: Of the 1,030 people assessed (392) 38.09 % Presented with a conspicuous wound ulcer, confirmed to be Buruli ulcer caused by *M. ulcerans* infection. This infection was very significant among the population cutting 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 infection can be acquired. Thus, the knowledge of the people about this infection is poor, believing that this infection is likely to be a traditional or spiritual disease rather than a normal infection.

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Conclusion: *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 again help to curb further spread of the infection.

Keywords: Emerging, Buruli Ulcer, Nigeria, Concerned, Ignorance.

Introduction

It was in 1948 that Sir Albert Cook first described Buruli ulcer 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 in 1998 classified Buruli ulcer as a "neglected emerging infectious disease[1,2,3]. 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 create the wound ulcer.

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.

In 2018, WHO received 2,713 reports of Buruli ulcer globally, and only in 2023, 1952 cases of Buruli ulcer were confirmed from 12 countries, with 1573 cases from the African Region and 379 from the Western Pacific Region. although rare, it typically occurs in rural areas near slow-moving or stagnant water[4,5].

Host Pathogen interaction

Buruli ulcer is an emerging infectious disease associated with high morbidity and unpredictable outbreaks. It is caused by *Mycobacterium ulcerans,* a slow-growing pathogen evolutionarily shaped by the acquisition of a plasmid involved in the production of a potent macrolide-like cytotoxin and by genome rearrangements and downsizing. These events culminated in an uncommon infection pattern, whereby *M. ulcerans* is both able to induce the initiation of the inflammatory cascade and the cell death of its proponents, as well as to survive within the phagosome and in the extracellular milieu. In such extreme conditions, the host is sentenced to rely on a highly orchestrated genetic landscape [5].

Signs and symptoms

The first sign of Buruli ulcer is a painless swollen bump or nodule on the arm or leg, often similar in appearance to an insect bite. Sometimes the swollen area instead appears as a patch of firm, raised skin about three centimeters across called a "plaque"; or a more widespread swelling under the skin[6]. Over the course of a few weeks, the original swollen area expands to form an irregularly shaped patch of raised skin. After about four weeks, the affected skin sloughs off leaving a painless ulcer. Buruli ulcers typically have "undermined edges", the ulcer being a few centimeters wider underneath the skin than the wound itself[6]. In some people (less than 10%), the ulcer may heal on its own or remain small but linger unhealed for years while in others (over 90%), it continues to grow wider and sometimes deeper, with skin at the margin dying and sloughing off. Large ulcers may extend deep into underlying tissue, causing bone infections and exposing muscle, tendon, and bone to the air[7]. When ulcers extend into muscles and tendons, parts of these tissues can be replaced by scar tissue then resulting in permanent disability[7].It is the secondary bacterial infection that makes the wound become reddish and painful with foul smelling[8]. Like Dracunculiasis, Buruli ulcers can appear anywhere on the body, but are typically on the limbs. Ulcers are most common on the lower limbs (roughly 62% of ulcers globally) and upper limbs (24%), but can also be found on the trunk (9%), head or neck (3%), or genitals (less than 1%)[8].

Scope of the problem

Recently, 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[3,9] and the status of this disease in the other 19 countries remain unknown, these are mostly countries from African continent.

Prevention and control

There are currently no known primary preventive measures for Buruli ulcer. The mode of transmission is again not known.The objective of Buruli ulcer control is to minimize the suffering, disabilities and socioeconomic burden among the affected people. Early detection and antibiotic treatment are the cornerstones of the control strategy. In many countries, community health workers play a critical role in case detection[10].

Diagnosis

In most cases, experienced health professionals in endemic areas can make a reliable clinical diagnosis, but training is essential.

Differential diagnoses of Buruli ulcer include tropical phagedenic ulcers, chronic lower leg ulcers due to arterial and venous insufficiency (often in elderly populations), diabetic ulcers, Cutaneous leishmaniasis, extensive ulcerative yaws and ulcers caused by *Haemophilus ducreyi*. Arteries carry oxygen-rich blood away from your heart to the rest of your body and the veins carry oxygen-poor blood back to your heart. By arterial insufficiency, it refers to blood flow problems in your arteries and venous insufficiency refers to blood flow problems in your veins [10]. Early nodular and papular lesions may be confused with insect bite, boils, Lipomas, ganglions, lymph node tuberculosis, Onchocerciasis nodules or deep fungal subcutaneous infections.

Four standard laboratory methods can be used to confirm Buruli ulcer: IS2404 polymerase chain reaction (PCR), direct microscopy, histopathology and culture. The bacterium grows best at temperatures between 29–33 °C (*Mycobacterium tuberculosis* grows at 37 °C) and needs a low (2.5%) oxygen concentration[11].

Treatment

Presently, there is no drug of choice for the treatment of Buruli Ulcer, however, present, present management consists of a combination of antibiotics and complementary treatments. A recent study suggests the combination of rifampicin (10 mg/kg once daily) and clarithromycin (7.5 mg/kg twice daily) is now the recommended treatment[12,13]. Interventions such as wound and lymphoedema 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. Those left with disability require long-term rehabilitation. These same interventions are applicable to other neglected tropical diseases, such as leprosy and lymphatic filariasis[14,15].

Justification of the study

Recently, there has been a 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 those 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.

Objective:

This study was therefore designed to determine the prevalence of this new infection among the Tiv people in North-central Nigeria and then assess the knowledge of the people concerning this emerging infection.

Materials and Methods:

The study area and the Population

The Tiv people in North central Nigeria constitute about 16 million people in population spanning in 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 Ijwo.

Predominantly they are found in Benue state where they constitute about 90% of the population of the state. They are mainly farmers thus the state is been tagged 'the food basket of the nation'- Nigeria. This study was carried out between December 2023 and August 20204 among this population with a particular interest on those in Benue state.

Sampling Technique

A non-probability sampling technique where sampling was based on convenience/accidental/ opportunistic sampling was deployed for this study.

Survey Method

Descriptive epidemiological survey was carried out as described by Michael et al in 2016 where time, place and persons of particular characteristics (in this case conspicuous wound ulcers) were assessed.

Laboratory Method

For the detection of *M. ulcerans* infections the microscopic detection of acid fast bacilli (AFBs) in stained smears was used and the DNA detection by PCR targeting the *M. ulcerans*-specific insertion sequence (IS) element IS2404 was deployed for confirmation. As a procedure, wound swabs were collected with particular interest on the edges and sites were the ulcer was first reported. Direct smears examinations were prepared using materials like; a pencil to label the slides from the swabs, adding 2ml of phosphate-buffered saline in the vortex wells, then the smear is been 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 Françoise in 2014 [10]. These standard laboratory procedures [11] were done primarily to confirm that all the wound ulcers seen were indeed those caused by *Mycobacterium ulcerans.*

Informed consent

Consent was first obtained from the traditional heads in the communities to gain access to their respective communities. Subjects who were willing to be interviewed were assured of their 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 had voluntarily participated in the study. All images in the research work were allowed to be published for the advancement of further research about the new infection.

Results

Table 1: Prevalence of and Knowledge about Brulia Ulcer (*Mycobacterium ulcerans* infection)-Ambi among the Tiv People in North-Central Nigeria-N=1030, in 113 Communities/Settlements/Enclaves

Parameters		Number=n (%) Examined	Number (%) infected
Age	20-29	263(25.5)	52(19.8)
	30-39	335(32.5)	171(51.0)
	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		
Gender	Male	732(71.1)	314(42.9)
	Female	298(28.9)	78(26.2)
	Total	1030(100.0)	**392 (38.06)** *P< 0.05
Education	Tertiary	176(17.1)	44(25.0)
	Secondary	416(40.4)	172(41.3)
	Non-formal	438(42.5)	176(40.2)
	Total	1030(100.0)	392 (38.06)

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P>0.05			
Profession	Civil Service	399(38.7)	161(40.4)
	Farming	631(61.3)	231(36.6)
	Total	1030(100.0)	392 (38.06)
P>0.05			
Knowledge about the infection	Yes I heard about the infection before now	17(1.6)	8(47.1)
	No, I did not hear about the infection in my life	1011(98.2)	384(38.0)
	Indifference/no clue	02(0.2)	0(0.0)
	Total	1030(100.0)	392 (38.06)
*How is the infection gotten to man	Spiritual Means	612(59.4)	351(57.4)
	Traditionally infected	913(88.6)	392(42.9)
	Through water contact	43(4.2)	34(79.1)
	Gotten from the soil	113(11.0)	109(96.5)
	Through insect bite	22(2.1)	13(59.1)

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

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

The table 1 showed 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 of 40-49 years 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 about this infection, only 1.6% have ever heard about this type of infection before among people in the community and 8 (47.1%) among them had the infection. The 98.2% of all the people examined had no idea of this infection before and among this group, 384(38.0%) have come-down with the infection. Only about 0.2% of the population studied remain indifference 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. Only about 4.2% of the people believed it was gotten through water contact and then 11.0%, 2,1% believed it was through soil and insect bite respectively.

Fig 1: **Photomicrographs of *Mycobacterium ulcerans* gotten from the wound ulcer on the leg.**

Here in fig.1, we present the images of a viewed slide of *Mycobacterium ulcerans* prepared from a swab from the wound ulcer, prepared using the Ziehl-Neelsen stain method and watched under electron microscope.

Fig 2: Photomicrographs of feet infected with *Mycobacterium ulcerans*[Ambi] in the study area showing the leg ulcers in some persons

The photomicrographs in fig.2 above represent the nature and pattern of the reported epidemic of wound ulcers among members of the affected communities in the study area.

Discussion and Conclusion

The 38.06% prevalence of Buruli ulcer infection observed in North-central Nigeria is very significant in communities around the north-central region of the country particularly for an infection which up till now its origin, mode of spread, management, prevention and control measures are not clear. This study showed that this infection has presented an emerging epidemiological concern in Nigeria like Lassafever 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] where they reported the infection to be more among the aged. We attributed this trend in our study to be of the fact that these are the most active age groups in thesecommunities thus, predisposing factors about the spread of this infection favor this age group. This finding is however not a wide departure from other works[12] as we observed the progression from 51.0% to 53.1% prevalences from the age group of 30-39 and 40-49 respectively, even though we reported a low prevalence of 3.1% in the age group of 50-59 years. Like others[13,16] the high prevalence of this infection among the males (42.9%) is an indication that this infection may have some resemblance to some activities in the communities but also not necessarily considering the female/ male gender issue. Moreover, the infection was considerably found in the females too (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.

It was of high interest to note from our findings that the educational status of the study population as well as the professional affiliations were seen not to have a barrier for this 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 ($P>0.05$), 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.

The traditional means have rather compounded situations particularly when leaves were grinded and covered on 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

It was discovered that up till this moment, the understanding about this infection still remains poor. People generally believed that the infection is acquired through the traditional or spiritual means coupled with the fact that the behavior of the wound differ significantly from all know wounds and the traditional means of treating normal wounds in their communities. How this infection is been gotten is still a mirage among the population. This was a clear picture of how the knowledge about this infection is poor. It was demonstrated when over 98% of the people examined have never heard about this infection before and over 88% believed that the infection can only be gotten through traditional means while 59.4% believed that bit can be gotten through spiritual means. These believes can only be over come when authorities concern will quickly come-in to educate the people about the disease otherwise as the disease spreads, these believes (though wrongly) will also keep spreading with devastating consequences. In other communities across the globe[12], people were not very much aware of this infection but were not attributing it to traditional or spiritual means as the mode of infection as seen in this study. Interestingly as knowledge about this infection remain poor, it is been compounded by these traditional believes and ignorant and if not attended to, these believes will soon take a center stage in the minds of the people thereby hampering further efforts of controlling this infection. In most Neglected Tropical Diseases (NTDs) like Onchocerciasis, Dracunculiasis and Schistosomiasis, traditional believes, poverty and ignorance have been the major factors militating against the smooth flow of control/eradication efforts among people in many developing countries. If measures are not effectively developed to curb this emerging Buruli ulcer infection in communities in our continent, it is believed that the same faith were programs are been mounted but with few/littleor less measurable effects about the control/elimination of the aforementioned NTDs, we will soon be in the same trend as it concern Buruli ulcer infection.

Conclusion

As Buruli Ulcer infection is significant among the study population in Nigeria, epidemiological parameters favor the spread of this infection among the population and other neighboring communities were also seen to include poor knowledge about the disease, poverty and ignorant. No age, gender, educational status or professional affiliations stand as a barrier for the spread of this infection. This disease (Buruli ulcer) was seen to be compounded in these communities by the lack of knowledge about the mode of infection and/or its spread as well as the non availability of adequate management or control measures in the study area. We recommend that proactive measures aimed at arresting this ugly situation among this population should be mounted. Health authorities (in this case; Local, State, Federal and International bodies) should come in quickly to educate the people about this emerging infection and mount health education awareness programs as well as Control/Eradication measures to halt the spread of this infection or ameliorate the suffering of the people from this emerging public health problem.

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