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Detection of a Neglected Tropical Disease: Case report of Heavy *Tunga penetrans* Lesions on the Feet of a Thirteen-Year-Old Boy from a Community in Lagos, Nigeria.

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Abstract

Tungiasis is a neglected tropical disease (NTD) arising from an ectoparasitic infection of the skin of its host by the gravid female Tunga species. The prevalence can spike to about 60% in impoverished regions of South America, the Caribbean, and Sub-Saharan Africa. Instances of severe cases are rare. However, according to the consistent pattern of Tunga penetrans distribution, majority of lesions are carried by a few numbers of hosts. Limited research has been conducted in endemic areas of Nigeria, and in Badagry, wherein a prevalence rate of 21.2% was recently documented. In this report, we detail a severe case of Tungiasis in Jegeme, an endemic community within the Badagry Local Government area of Lagos, which was observed during part of an active surveillance conducted from August 2021 to November, 2021. The case involved a 13-year-old boy who reported several lesions containing embedded fleas on his limbs. Extraction and microscopic examination of the wound revealed eggs and adult forms of Tunga flea. This case highlights the persistence of severe tungiasis within this endemic community, underscoring the link between the infection and extreme poverty. Tungiasis is likely to remain endemic in such resource-poor setting where extreme poverty limits access required to prevent infestation. Appropriate response to infestation to reduce morbidity should be implemented. Improved links between locals in endemic populations and healthcare providers, coupled with increased awareness, and implementation of preventive measures is crucial.

Keywords : *Tunga penetrans*, Ectoparasite, Flea, Skin-NTD, Endemic

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INTRODUCTION

Tungiasis is a skin infection brought about by the invasion of Sandfleas, *Tunga penetrans* into the host's skin (Wiese *et al*., 2018). Since 2017, tungiasis, alongside scabies and myiasis, has been categorized as a Neglected Tropical Disease (Calvopiña and Bezemer, 2021). This condition is prevalent and predominantly observed in persons living in hard-to-reach poor coastal communities (Thielecke *et al*., 2013). An estimated 668 million people are considered to be at risk of this infection in sub-Saharan Africa (Elson *et al*., 2023). Tungiasis displays identifiable clinical features, including white nodules containing black centres that trigger an inflammatory reaction due to female sand fleas embedded into the skin (Mutebi *et al*., 2023). The resulting morbidity arises from this inflammation, leading to symptoms like swelling and redness surrounding the lesions (Coates *et al*., 2020). Patients often endure itching and severe pain, potentially leading to ulcers and, in severe cases, complications such as gangrene, sepsis, tetanus, deformation and loss of nails and auto-amputation of digits and fissures (Pilger *et al*.,2008; Nsanzimana *et al*.,2019).

The disease exhibits a low mortality rate however, its high morbidity rate stems largely from the negligence of public health authorities and even the afflicted individuals in effectively addressing the infection (Wiese *et al*., 2018). Its impact affect the health of these underprivileged individuals potentially constraining their productivity as well. Timely identification is crucial as neglecting this disease could lead to various complications. We hereby report a case of heavy infestation with *Tunga penetrans* in a 13-year-old male from Jegeme, a fishing community in Badagry Local Government Area of Lagos State.

CASE REPORT

A 13-year-old boy with low socioeconomic status presented to us in November 2021 with lesions on his feet during an active surveillance study in Jegeme village. The latitude of Jegeme community in Badagry is 6.39781 and the longitude is 3.00704, with a population of about 4,500 inhabitants who are predominantly fishermen and fish traders. The community lacks appropriate amenities such as electricity, modernized toilet facilities, water supply and also lacked health facilities.

This study was approved by the ethical committee of Nigeria Institute of Medical Research (NIMR) with Institutional Review Board (IRB) approval number IRB/21/053. Permission was obtained from the Badagry Local Government Area Public Health Board for the study. Additionally, consent was obtained from the traditional community leader of Jegeme. The study's purpose was communicated to the community members, and both verbal and written informed consents and approvals were secured in order to administer questionnaires and conduct clinical examinations. The boy responded to the pre-tested questionnaires, stating that he had a history of walking bare footed and admitted to being bitten by sandfleas. He had a very dirty appearance with dirty clothes and feet. The house he lives in is built with dried leaves with sandy floor (Plate 1) and there were animals such as dogs, chickens and goats roaming freely around and into his compound.

Plate 1: Hut of heavily infected boy.

When physically examined, several lesions with small black central core were distributed on the soles, heels and toes of the right and left foot (Plate 2). He had a total of 40 embedded fleas. Diagnosis of tungiasis was made based on the clinical history and physical findings. The lesions were opened up to remove the content using surgical blade and sterile needle, thereafter the wound was treated with antiseptic. Petroleum jelly was applied to the extraction site following the removal of embedded fleas (Plate 3). When the extracted fleas were examined using a digital microscope, it showed the adult *Tunga* flea with eggs (Plate 4) housed within the neosome (Plate 5).

Plate 2a-b: Left foot of infected boy during excision of embedded fleas

Plate 3: Microscopic view of embedded fleas extracted from lesion

Plate 4: Microscopic view of eggs within extracted lesion

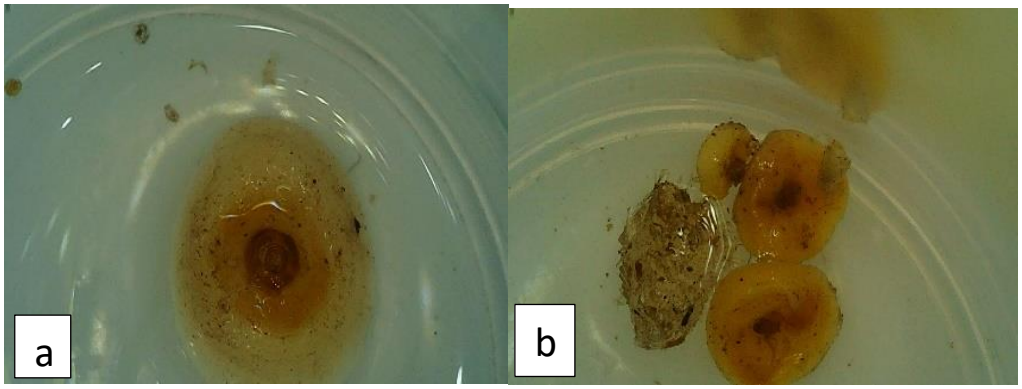

Plate 5a-b: Microscopic view of Neosomes extracted from lesion of infected boy

DISCUSSION

Tungiasis, an ectoparasitic infection, continues to be overlooked despite its significant impact on morbidity within endemic regions. This infection arises from the penetration of the gravid female sand flea, *Tunga penetrans*, into the host's skin (Otubanjo *et al.,* 2016). The infestation by sandfleas is linked to poverty and is endemic in countries across the Caribbean, South America, and Africa (Deka and Heukelbach, 2022). Several studies (Wilcke *et al*., 2002; Ugbomoiko *et al*.,2007; Collins *et al.,* 2009; Nyangacha *et al*., 2019) have been conducted in Brazil, Nigeria, Cameroon, and Kenya. Within these regions, reported prevalence reached up to 60% in endemic communities (WHO, 2022). The current epidemiological status within the African continent remains uncertain. In Nigeria, few studies have been done in endemic communities of Lagos State with prevalence ranging between 21.3% to 45.2% by some researchers (Ade-Serrano and Ejezie, 1981; Ugbomoiko *et al*., 2007; Otubanjo *et al*., 2016; Heukelbach *et al*., 2021).

The diagnosis of tungiasis is mostly clinical and the disease exhibits a higher prevalence among children compared to adults, a trend attributed to children's behavioural habits that increase their susceptibility to infection (Wilcke *et al*., 2002). Infestations have been associated with specific sociocultural factors, including walking barefooted or wearing uncovered sandals, living in houses with sandy floors, inadequate personal hygiene, the unrestricted movement of animals between and into households, social neglect, and insufficient health-seeking behaviour (Muehlen *et al*., 2006; Tamene, 2021).

In deprived communities, Tungiasis has a high transmission potential and increased chances for development of the severe form of the disease. It is debilitating and incapacitating in people suffering from the severe form of the infestation (Mørkve *et al*., 2023). It has been

established to impair life quality in afflicted individuals (Wiese *et al.,* 2018). The case study subject stated that he walks barefooted while working on the farm and around his neighbourhood. His appearance and living conditions depict his state of poverty and low living standards. A similar severe case of Tungiasis in a 54 year old farmer was also reported in Ilaje, another endemic community in Badagry Local Government area of Lagos during this active surveillance exercise (Olusegun-Joseph *et al.,* 2022). Based on the consistent distribution pattern of *Tunga penetrans*, a small number of hosts typically carry the majority of lesions (Muehlen *et al*., 2006).

The microscopic examination revealed an oval structure bordered by a thick capsule with multiple eggs and parasite exoskeleton fragments compatible with *Tunga penetrans*. The black central opening corresponds to the posterior portions of the abdomen of the embedded flea. Majority of *Tunga* lesions typically occur on the feet and toes, particularly in the areas beneath and around the nails (Mazigo *et al*., 2011). Detecting the condition early decreases the chance of bacterial infection which may lead to complex issues like ulcers, tetanus, gangrene, and the need for toe amputation (Miller *et al*., 2019). The primary treatment for Tungiasis in endemic communities involves surgically extracting embedded sand fleas, often by using unsuitable tools like thorns or sharpened wooden sticks (Thielecke *et al*., 2013).

CONCLUSION

Collectively, this case highlights the persistence of severe Tungiasis within this endemic community, suggesting that the actual occurrence of this debilitating condition is likely underreported.

This neglected disease of concern in underprivileged societies may be preventable and curable if prompt treatment is made available to patients in remote settings where health coverage is poor to avoid life-threatening sequels.

Tungiasis is likely to remain endemic in such resource-poor setting where extreme poverty limits access required to prevent infestation. Appropriate response to infestation to reduce morbidity associated with infestation should be implemented. Improved links between locals in endemic populations and healthcare providers, coupled with the recognition of this parasite as a public health disease is of utmost importance.

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