

Tungiasis in Northern Tanzania: a clinical report from Qameyu village, Babati District, Manyara Region

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Abstract

Introduction: Tungiasis is an infestation caused by the penetration in the skin of the gravid female of the flea *Tunga penetrans* (*T. penetrans*). The current epidemiological situation of tungiasis in Eastern Africa is poorly known. We present the results of a cross-sectional study on tungiasis which was carried out in Qameyu (Northern Tanzania).

Methodology: Sixty-two schoolchildren with suspected cases of tungiasis were examined. Location, number, morphology and symptoms associated with *T. penetrans* infestation were recorded for each patient.

Results: A total of 62 schoolchildren (38 males and 24 females), with ages ranging from 6 to 14 years, were examined. Sixty children were infested by *T. penetrans*. A total of 865 lesions were observed: 170 lesions were vital and 695 were non-vital. The first and the fifth toes were especially involved. The highest number of lesions observed in a single patient was more than 55 lesions. Pain was reported by 42 children, itching by 39 and difficult walking by 28. One child presented with fever which was considered to be caused by superinfected tungiasis. Complications were nail dystrophy (48 patients), deformity of the fingers or toes (12 patients), scarring (4 patients) and nail loss (4 patients). Thirteen children needed oral antibiotic therapy because of bacterial superinfections.

Conclusions: Tungiasis is a public health concern in this region of Tanzania and it is associated with high morbidity. Improvement in housing hygiene, confining domestic animals and increasing the knowledge of the disease via health education are measures that should be taken to control the disease.

Key words: Tanzania; *Tunga penetrans*; tungiasis.

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Introduction

Tungiasis is an infestation caused by the penetration in the skin of the gravid female of the flea *Tunga penetrans* (*T. penetrans*) Linnaeus 1758. *T. penetrans* currently lives in Central and South America and sub-Saharan Africa [1]. Tungiasis is characterized clinically by papular or nodular lesions, either single or multiple: cases with dozens, sometimes even hundreds, lesions are not rare; lesions can be white, grey or yellowish in colour, with a small brown-black central opening corresponding to the posterior portion of the flea abdomen [1]. Characteristic locations of tungiasis are toes, periungual and subungual folds, interdigital folds, sole and heel [1]. The whole process, from the penetration of the gravid female until the healing, takes 4 to 6 weeks. According to the “Fortaleza classification”, the natural history of tungiasis can be divided into five stages: a) penetration phase; b) phase of hypertrophy;

c) “white halo” phase; d) involution phase and e) residues in the host’s skin [2]. The penetration of *T. penetrans* is asymptomatic: it is only when the insect increases in size that the inflammatory phenomena develop, leading to pain and pruritus. Pain can cause marked limitation in walking [1]. Bacterial superinfections are the most frequent complications. Lymphangitis, lymphadenitis, cellulitis, osteomyelitis, gangrene, sepsis, loss of nails and spontaneous amputation of the toes have also been described [1]. Risk of tetanus should also be taken into consideration [1].

To date, very few studies on tungiasis epidemiology in Africa have been published [3-8]. In 1981, Ejezie reported that 49.5% of primary schoolchildren in the Lagos State (Nigeria) were affected by tungiasis [4]. Similar data were recorded in 1984 among primary and post-primary school pupils in the Niger delta [5]. Knowledge on the current

epidemiological situation of tungiasis in Eastern Africa is limited: to our knowledge, only two studies have been carried out in the Northwestern area of Tanzania [10,11]; both studies confirmed that prevalence and morbidity are high.

We present the results of a cross-sectional study on tungiasis which was carried out between May and June 2012 and April 2013 at the Qameyu village (Babati district, Manyara region, Northern Tanzania).

Patients and methods

We carried out our activity at Qameyu Health center. Qameyu and the surrounding villages are located at approximately 1,500 metres above sea level. People live in poor houses with sand or mud floors. Inhabitants are mostly farmers and often keep domestic animals, such as cows, pigs, goats and dogs inside their houses. There are no urban services, such as electricity and water supply. Health services are poor. People do not recognize tungiasis as an important health problem, even when severe disease is present. In approximately 50% of affected children, fleas are regularly removed at home, usually by parents. In Qameyu and surrounding villages, children do not use proper footwear (they usually wear open sandals made from old tyres), and often walk long distances to reach the school. Conversely, many adults and adolescents wear socks and closed shoes, which prevents severe tungiasis.

Our observations were made in April, May and June, during the cold and rainy season, when the incidence of tungiasis is lower [12]: in Northern Tanzania, rainy season lasts from November to May.

Because of the short time available, we asked the schoolteachers to select the children with any signs/symptoms of tungiasis such as pain or lesions on the feet and hands and send them to the health center to be examined by our team.

The total number of pupils in attendance at the primary school of Qameyu village, reported by the teachers at the time of the study, was 220. We

examined 62 of these children.

The location, number, morphology and symptoms associated with *T. penetrans* infestation were recorded for each patient.

In accordance with the Fortaleza classification system [2], we considered “vital flea” the round, whitish lesions, with a central black dot of 4-10 mm in diameter; “non-vital flea” presented instead as black thickening skin surrounded by necrotic tissue.

Shoes were distributed to all children.

Results

Of the 62 schoolchildren examined; 38 were males (61.3%) and 24 females (38.7%), with ages ranging from 6 to 14 years (mean age: 10.4 years). The percentage of affected children in the school was 27.3 %.

Sixty children (97%) were infested by *T. penetrans*; 2 children (3%) showed only nail dystrophy, a clinical marker of previous tungiasis.

A total of 865 lesions were observed: 170 lesions (19.6%) were vital and 695 (80.4%) were non-vital. Lesions were located, respectively, on the right toes, left toes, right sole, left sole, left hand, right heel, right hand and left heel. The first and the fifth toe were especially involved (Table 1). The highest number of lesions observed in a single patient was more than 55 lesions: we were unable to establish the exact number of lesions because of the presence of clusters on the heels and toes (Table 1).

Pain was reported by 42 children (67.7%), itching by 39 (62.9%) and difficulty in walking by 28 (45.1%). Thirteen children (20.9%) were unable to attend school on occasions because of difficulty in walking. One child (1.6%) presented with fever which was considered to be caused by superinfected tungiasis.

Complications were nail dystrophy (48 patients: 77.4%), fingers or toes deformity (12 patients: 19.3%), scarring (4 patients: 6.5%) and nail loss (4 patients: 6.5%). Thirteen children (20.9%) needed an oral

Table 1. Location and number of lesions.

Location of lesions	Number of lesions
Right hand	20
Left hand	22
Right heel	20+9 patients with clusters
Left heel	11+5 patients with clusters
Right sole	64
Left sole	25
Right toes	353: First = 118; Second = 61; Third = 40; Fourth = 42; Fifth = 92+ (*)
Left toes	350: First = 102; Second=55; Third = 50; Fourth = 41; Fifth = 92

(*) Number followed by “+” indicates a higher number: we were unable to count accurately the number of lesions due to the presence of clusters.

antibiotic therapy because of bacterial superinfections (Table 2).

Tetanus prophylaxis is usually performed by the governmental health program. It was necessary in only one case. Crusted/purulent/necrotic lesions and embedded fleas were removed using a curette or a needle.

Discussion

Unlike other studies performed in African countries [8,11], which recorded higher incidence of tungiasis in children and elderly, we observed tungiasis only in children with an age ranging from 5 to 14 years. Although this study was performed only on children, all patients coming to the health center were examined (approximately 50 subjects daily). No adults or older subjects affected by active tungiasis were found, with the exception of a woman with mental problems affecting her ability to take care of herself. However, we observed in these adults hyperkeratosis and deformity of feet due to previous tungiasis (Figure 1).

Moreover, we noticed that adults and children over 14 years of age were wearing better footwear compared to children, which may be the reason of the lower incidence of tungiasis among them. In addition, they are able to routinely perform self manipulation of the lesions when present.

In support of these hypotheses, no students from Qameyu secondary school were examined, as teachers could not find any candidates with lesions on the feet or pain. During our visit to the secondary school, we found that all students were wearing proper footwear (socks and/or shoes).

A limitation of our study was the fact that unfortunately not all children on role attend the primary school in African rural areas. Therefore, children in the same age range of those examined who were not attending the school, either because of the poor road conditions due to the rain, or because of

Figure 1. Chronic, hyperkeratotic tungiasis of the heel.



poverty or low education level of the families were excluded from the study. In addition, it was not possible to the number of affected children during the dry season, when the incidence of infestation is higher; hopefully, further studies will be conducted in the future to address this.

A higher number of males compared to females (38 vs 24) was also observed; it is difficult to establish whether this is significant, due to the small sample of population. Gender differences may vary from community to community, according to local habits and specific behaviours that could increase transmission based on gender [11].

Toes were the main site of infestation, especially the first and fifth toes, probably due to their exposed surfaces. Clusters of embedded fleas usually located at the heels or at the first or the fifth toe, with necrosis of the surrounding tissue known as “honeycomb-like

Table 2: Symptoms and signs of individuals with tungiasis (n = 60).

Signs and symptoms	
Pain	42 (70%)
Itching	39 (65%)
Difficulty walking	28 (46.7%)
Lost days of school	13 (21.7%)
Fever (due to bacterial superinfections)	1 (1.7%)
Nail dystrophy	48 (80%)
Fingers/toes deformity	12 (20%)
Scarring	4 (6.7%)
Nail loss	4 (6.7%)
Bacterial superinfections	13 (21.7%)

lesions”, were observed. [13]. In these patients it was impossible to determine the exact number of the lesions. In some cases, vital fleas were present even below lesions characterized clinically by necrosis or hyperkeratosis. After years of infestation, these lesions can leave permanent deformity of the heel, in particular in adults (Figure 1) [14]. Another finding, which to our knowledge has never been described, was the presence of lytic lesions beneath the nail plate, which appear as small holes (Figure 2). This could be due to keratolytic enzymes produced by the flea.

Tungiasis associated morbidity, such as pain, difficulty in walking and deformity of toenails, was commonly reported (Table 2). These clinical manifestations have been reported in different studies [8,10,13,14]. One of the most common symptoms reported in our study was itching (62.9% of patients), which is believed to facilitate the leakage of eggs. Another common symptom was pain, which in several cases caused difficulty in walking: pain associated with tungiasis may result in school absenteeism. About 2/3 of children had pain, almost half reported difficulty in walking and 20% declared loss of school days because of complications due to tungiasis. This demonstrates once again that tungiasis does not only have a high morbidity, but also important psychosocial and educational consequences in an area where schooling is low and access to school is made difficult by distance and lack of transport.

Figure 2. Lytic lesions beneath the nail plate.



Complications such as nail dystrophy, fingers or toes deformity and bacterial superinfections were also common. In particular, nail dystrophy was observed in a high percentage of patients (77.4%).

Numerous ectopic lesions were observed on the hands: this should be always taken into consideration when diagnosing tungiasis in endemic areas. We did not find ectopic lesions in different areas such as elbows or buttocks.

Encouragingly a health educational programme on tungiasis recently started at Qameyu with the collaboration of local nurses. We hope this can be extended to other areas in Northern Tanzania.

Conclusions

The present study showed that tungiasis is a public health concern in this area of Northern Tanzania and it is associated with high morbidity. Improvement in housing hygiene, confining domestic animals, increasing the knowledge of the disease and adopting health education programmes and providing shoes are measures that should be taken for the control of the disease.

Further studies are needed on representative population samples, to provide a more complete picture of tungiasis in Manyara region.

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