

Tungiasis – A cause of painful feet in a tropical traveller

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KEYWORDS

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Summary Tungiasis is an ectoparasitosis caused by the impregnated female sand flea *Tunga penetrans*. It is endemic in certain resource poor areas around the world and imported infestations in travellers can lead to considerable morbidity. With the rise in international travel and immigration, the likelihood of physicians encountering such tropical skin infestations is rising. The ability of physicians to recognise tungiasis early will be immensely beneficial to patients. We describe a case of tungiasis where a traveller presented with painful foot lesions. The patient had returned to the United Kingdom 4 days previously after spending 4 weeks in the Pantanal region in Brazil. A literature review on this subject was undertaken in this article. © 2009 Elsevier Ltd. All rights reserved.

Case report

A 39 year old gentleman with a background of neurofibromatosis was admitted to hospital with painful lesions on his feet. The patient had returned to Britain 4 days prior to admission after travelling extensively in Asia (India, Singapore) and South America (Chile, Peru, Bolivia, Brazil) in the previous eight months. The patient had been in the Pantanal region of Brazil the four weeks before admission where he had walked barefoot on occasions. The patient

had noticed painful lesions on his feet about 10 days pre-admission. On clinical examination he appeared well. He was afebrile and haemodynamically stable. The only abnormalities to find were five, round, 0.5 cm diameter, papular lesions on both feet. The lesions were white/pale yellow with a central black punctum (Fig. 1). There was no associated lymphadenopathy. The lesions were tender on palpation and painful on walking.

The lesions were excised under local anaesthetic and aseptically dressed. Microscopy of excised samples confirmed *Tunga penetrans* infestation (Figs. 2–4). The patient recovered without any complications.

Discussion

Tungiasis is a parasitic skin infestation caused by the female sand flea *T. penetrans* or Chigoe flea, which

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Figure 1 Typical foot lesions of tungiasis (papular pale yellow lesions with a central black area).

burrows into the epidermis of its host.¹ It was first reported in crewmen who sailed with Christopher Columbus,² and it is one of the few parasites, which has spread from the western to the eastern hemisphere. It was carried to Africa (Angola) in the 19th century in the ballast sand of an English vessel sailing from Brazil.³ The causative flea is endemic in Central and South America, on several Caribbean islands including West Indies, and sub-Saharan Africa.^{4–6} Sporadic occurrences in India⁷ and on the Mediterranean coast have been reported.⁸ With global warming, increased foreign travel and continued immigration from endemic areas the chances of encountering cases of tungiasis in Europe are increasing.

Human infestation is endemic in resource poor rural communities and in slums of urban centres where it remains a neglected disease in the marginalised resource poor communities. The main habitat of *T. penetrans* is warm dry soil, sandy beaches, stables and stock farms.² Prevalence in hyper-endemic areas can reach 54%.^{9–12} This can vary during the year with increasing number of infestations occurring in the dry season,¹³ possibly due to a reduction in parasite numbers during the wet season and individuals spending less time outdoors.⁵ It is usually more

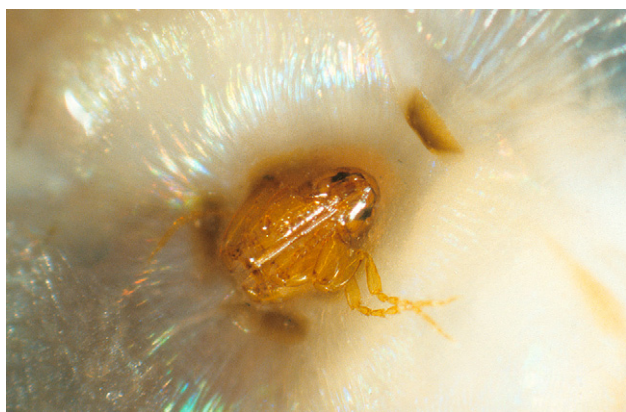


Figure 2 Female sand flea, *T. penetrans* under the dissecting microscope.

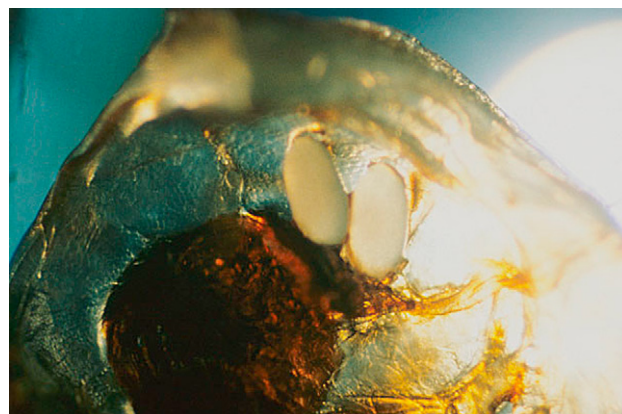


Figure 3 Female flea with multiple ovoid eggs.

common in males than in females and adults have less infestation than children,¹³ although prevalence can increase in the elderly. This is thought to be due to patterns of exposure, but keratinisation of the skin of the feet may also play a role.

To reproduce, the flea requires a warm-blooded host. Domestic animals, farm animals, rodents and other wild animals act as reservoir hosts.² Male and non fertilised female fleas feed on warm-blooded hosts intermittently. However once impregnated, the female flea anchors and then borrows deep in to the epidermal-dermal junction and feeds on blood from dermal capillaries of the host.^{3,14} Keratolytic enzymes may be involved in this process. Expansion of the flea 1000–3000 times its original volume (often reaching 1 cm in diameter) follows with the head

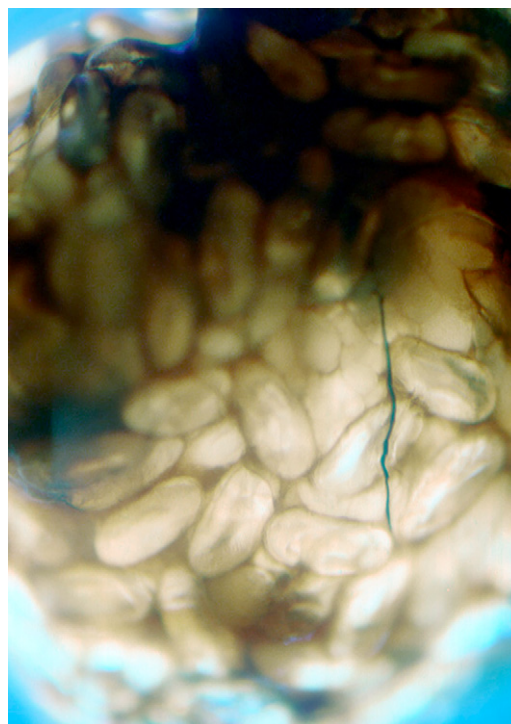


Figure 4 Multiple expelled ovoid eggs of *T. penetrans*.

positioned in the upper dermis and the caudal tip of the abdomen at the skin surface forming a punctum. This opening is used for breathing air and for releasing eggs (sometimes more than a hundred) after a 1–3 week period. Death of flea follows and the eggs are hatched on the ground, become larvae and pass through pupal stages before becoming adults in 2–3 weeks. Life cycle normally takes about 4 weeks to complete.^{3,14}

The flea is a poor jumper and tends to parasitise the periungual area of the toes, the heels and the soles of feet as seen in our patient (Fig. 1). However, embedded sand fleas can be found on almost every part of the body including, hands, neck and the genital region.^{15,16} Severe infestations of more than 100 imbedded sand fleas have been reported. Individual lesions may be painful, although sometimes they are pruritic or even asymptomatic. Although it is a self-limiting infestation, debilitating and disfiguring complications can occur.¹⁷ Loss of toenails, fissures, ulcers, gangrene, lymphoedema, deformation, and auto-amputation of digits are such examples. Secondary bacterial infections of tungiasis lesions can lead to formation of pustules, abscesses, tissue necrosis, lymphangitis and septicæmia. Organisms involved in bacterial superinfection may include *Staphylococcus aureus*, *Streptococcus pyogenes*, various *enterobacteriaceae*, and rarely *Pseudomonas* and *Bacillus* species.^{1,3} Anaerobes such as pathogenic species of *Clostridia* can cause infection by gaining a foothold in soil contaminated tungiasis lesions. Entry of *Clostridium tetani* spores into lesions can lead to tetanus in non-vaccinated individuals.^{6,18,19}

Diagnosis of ectoparasitosis is usually made clinically taking into consideration the localisation and the morphology of the lesion. Dermoscopy may aid in the visualisation of fleas and eggs.²⁰ Although skin biopsy could be performed it is generally not indicated for diagnosis or treatment. *T. penetrans* infestation usually presents with papular or nodular, single or multiple lesions. The lesions are white, grey or pale yellow in colour with a small brown-black central region usually localised to the feet as in our case²¹ (Fig. 1). Patients can also present with crusted, bullous, pustular, as well as ulcerative and planter wart-like lesions.^{17,21} Recent history of travel to an endemic area helps arrive at a diagnosis. Differential diagnoses include; verruca vulgaris, myiasis, mycosis, pyogenic infection, infected insect bite, dracunculiasis, dermoid cyst and melanoma.⁴

Surgical extraction of the flea under sterile conditions is the most appropriate treatment. Fleas should be extracted at the earliest convenience to avoid secondary infections. Extraction is more difficult when the flea is engorged. The epidermal punctum should be carefully widened using a sterile blunt needle to enable the extraction of the entire flea. Care should be taken to prevent tearing of the flea during extraction and to avoid parts of the flea being left behind due to the risk of severe inflammation ensuing. After extraction the patient should be treated with antibiotics if secondary infection is suspected. Topical antibiotics may be sufficient in most cases although systemic antibiotics may be required in severe cases. Tetanus prophylaxis is indicated in international refugees as well as travellers who had not received tetanus vaccine prior to travel. Currently there is no effective drug available to

treat Tungiasis (or at least none for which a parasitocidal effect has been clearly documented). A randomised trial by Heukelbach J et al., showed that topical ivermectin, metrifonate or thiabendazole can each significantly reduce the number of lesions caused by embedded sand fleas although further studies are however needed to optimise doses.²² Oral ivermectin (200 µg/kg with a repeat dose after 10 days) has been reported to be effective,²¹ although a study by Heukelbach J et al., showed that there was no significant difference in any of the outcome measures between the oral ivermectin and the placebo group.²³ Systemic treatment with niridazole (30 mg/kg) in a single dose has been suggested by certain authors for extensive infestation in the past,²⁴ but given the unfavourable side effects this is no longer a suitable therapeutic option.

Prevention of infestation is therefore vital and pre-travel health advice to travellers should include information on risks of acquiring tungiasis, and steps that could be taken to prevent an infestation.²⁵ Use of adequate clothing, closed footwear and socks to reduce the exposed skin area may prevent tungiasis to a certain degree although complete protection may not be achieved. Daily inspection of the feet and immediate extraction of embedded fleas can also offer some protection. Certain insect repellents may prove to be effective.²⁶ In endemic areas prevention could be achieved by environmental controls which require spraying the ground with insecticides such as malathion and sweeping floors although this may not be practical. Close contact with domestic or farm animals, which may serve as vectors in endemic regions, may increase the risks of transmission and therefore should be avoided.³ In addition to preventing tungiasis these steps may also benefit the travellers by reducing the likelihood of other parasitic infestations such as cutaneous larva migrans. Travellers with peripheral neuropathy should take added precautions as they may not even notice flea infestations due to lack of symptoms.

Our patient had travelled extensively in many tropical countries. Taking into consideration the life cycle of *T. penetrans* it is likely that he acquired the infestation in the Pantanal region of Brazil where he spent the last 4 weeks of his holiday. He requested medical help after 10 days of noticing the lesions and effective treatment led to an uneventful recovery. Adequate pre-travel advice would have enabled the patient to recognise the lesions early and to seek help earlier. Furthermore the infestation may have been prevented altogether had he been aware of the risks of walking barefoot.

Tungiasis remains a significant problem in endemic areas. Travellers to these endemic areas may import *T. penetrans* on their return home. In addition to holiday-makers, immigrants, missionaries and military personnel may also introduce *T. penetrans* to other countries. Prevention and early recognition would help reduce morbidity. Pre-travel health advice is therefore vital and should focus on steps that could be taken to avoid infestation. It is also important that physicians and general practitioners are aware of this condition and consider the diagnosis in travellers with painful foot lesions. Early diagnosis and treatment would be of immense benefit to patients.

Conflict of interest

No conflict of interest.

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