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Tungiasis

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Key facts

- Tungiasis is caused by adult female sand fleas, which burrow into the skin mostly of the feet.
- Tungiasis is commonly known as pulga de areia, niguá, pique, bicho do pé, bichodo porco or jatecuba, jigger, sand flea or chigoe.
- It causes immense pain and itching, difficulty walking, sleeping and concentrating on school or work.
- Tungiasis can be associated with abscesses caused by secondary bacterial infections.
- It occurs in marginalized, resource-poor populations in the tropics of the Caribbean, South America and sub-Saharan Africa.
- Both animals and humans are susceptible to infection.

Overview

Tungiasis is caused by the adult female sand flea, *Tunga penetrans*. The larvae and pupae develop in dry shaded soils, mostly inside the sleeping rooms of houses with an unsealed earthen floor where most transmission occurs. The embedded flea causes inflammation, pain and itching, difficulty walking, sleeping and concentrating on school or work. Tungiasis is a zoonosis that affects humans and animals alike.

The only product shown to have high efficacy and safety for treatment is NYDA[®], a combination of dimeticone oils. Control will require a One Health approach, treating the patients as well as spraying floors with insecticide or sealing them, daily foot washing with soap, and treating any infected animals owned by affected families.

Scope of the problem

T. penetrans is found in tropical and subtropical regions of the Caribbean, South America and sub-Saharan Africa. Over 1 billion people live in areas suitable for transmission of tungiasis but no country conducts routine surveillance so the actual disease burden is not known. However, within endemic communities, surveys have reported prevalence from 7% to 63%, i.e., distribution is heterogeneous.

Who is at risk?

Elderly people and children aged 5–14 years, particularly boys, are at highest risk. People with disabilities are also highly vulnerable to infection.

Tungiasis thrives where living conditions are precarious, such as villages located in remote beaches, communities in the rural hinterland and shanty towns of big cities. In these settings, the poorest of the poor carry the highest burden of the disease.

Signs and symptoms

Tungiasis is diagnosed by visual inspection, the live fleas appearing as a whitish disc varying in size with a dark point in the middle that darkens with time until dead and entirely black. In areas where the disease is endemic, affected individuals, even children, typically know whether they have tungiasis. Most affected individuals attempt to extract the fleas, leaving a typical circular lesion, often with the blackened remains of the dead flea. This is a clear indication of recent infection.

The acute and chronic morbidity associated with tungiasis results from an inflammatory reaction around embedded female sand fleas, exacerbated by bacterial superinfection. During the acute phase, erythema, oedema, desquamation, pain and itching are constant. Itching induces scratching of the lesion, which in turn facilitates bacterial superinfection. Abscesses, sometimes large, are common.

The feet are the most common infection point but infestation can occur in all parts of the body. Bullous-type lesions have also been reported. Fissures, ulcers, lymphangitis, lymphoedema, ascending neuritis, deformation and loss of nails, and tissue necrosis are

chronic complications. These result in pain, disability, disfigurement and mutilation of the feet, causing characteristic changes in the way people with tungiasis walk.

Transmission

The main transmission site is inside the sleeping rooms of houses with an unsealed earthen floor where the larvae and pupae develop after the eggs are dropped there. The adult female sand flea burrows into the skin and grows 2000 times in size as eggs develop. The female flea typically lives for 4–6 weeks, during which the eggs are expelled and fall to the ground. The toes, sole, lateral rim of the foot and heel are common sites of infection, and 99% of all lesions occur on the feet.

In some areas, several mammalian species have been found to act as reservoirs for human infection. In rural areas, these are predominantly pigs and bovines; in resource-poor urban communities, they are found in dogs, cats and rats. In some areas, infection can be transmitted without an animal reservoir when skin comes into contact with soil or a floor where adult sand fleas have developed.

Impact

The embedded flea induces inflammation associated with immense pain and itching. This disturbs sleep and concentration on school or work. Patients with large numbers of embedded fleas have difficulty walking, often with loss of nails and disfigured and mutilated feet. People with tungiasis experience stigma and social exclusion and a low quality of life. Children with tungiasis have cognitive impairment and lower school exam scores. Impaired physical fitness of adult household members could have a negative impact on household economics. Bacterial superinfection may cause life-threatening complications, such as septicaemia, tetanus or gangrene.

Treatment

In endemic areas, mechanical extraction of burrowed sand fleas is common as an act of despair. This is usually done by the patients themselves or a caregiver. Embedded parasites are removed under non-sterile conditions using instruments such as sticks, hair pins, thorns, safety pins, sewing needles or scissors. The procedure is painful and traumatizes children. Removing the fleas can cause local inflammation if the parasite ruptures and introduces pathogenic bacteria, leading to further superinfection of the sore. The instrument is often subsequently used on several people, which risks transmission of diseases such as hepatitis B virus (HBV), hepatitis C virus (HCV) or even HIV.

Mechanical extraction should only be performed with surgical instruments by an experienced nurse under sterile conditions. After removal of sand fleas, the wound must be dressed appropriately and the tetanus vaccination status verified and a booster vaccination given, if indicated.

Topical treatment with a formula of two dimeticone oils with low viscosity (NYDA[®]) is highly effective and safe.

Prevention and control

The major risk factor for tungiasis is extreme poverty, which drives behaviour that puts people at risk for infection. This includes living in a house with an unsealed earthen floor not washing feet regularly and not using soap when washing. In some communities, infection is also linked to ownership of dogs or pigs.

Thus a long-lasting reduction of incidence and of tungiasis-associated morbidity can only be achieved through a One Health approach integrating behaviour change to increase soap use in daily foot washing, spraying floors with insecticide or sealing them, treating animal reservoirs where they are infected and treating humans.

The regular application of a repellent based on coconut oil effectively prevents the fleas from penetrating the skin. When the repellent is applied twice daily on the feet, tungiasis-associated morbidity rapidly decreases and approaches zero after 8–10 weeks. Even if applied intermittently, the reduction of morbidity is significant.

Challenges

The key challenge is the lack of funding and attention on the disease by governments and funding agencies. As a consequence of this, no country knows its disease burden nor distribution. The highly effective dimeticone treatment is not available in endemic countries and no safe and effective alternatives have been explored sufficiently nor intervention trials to identify effective prevention interventions.

WHO response

In May 2013, the 66th World Health Assembly resolved to intensify and integrate measures against neglected tropical diseases such as tungiasis and to plan investments to improve the health and social well-being of affected populations. WHO works with Member States and partners to ensure the implementation of resolution [WHA66.12](#). In 2022, WHO

published the [skin NTDs framework](#) to promote integration across different skin diseases. Tungiasis is included in this document and the [NTD road map](#) to increase surveillance and visibility of the disease.

- **Report of a WHO informal meeting on the development of a conceptual framework for tungiasis control: virtual meeting, 11–13 January 2021**
International Alliance for the Control of Scabies
- **Global network committed to elimination of scabies as a public health problem**
International Foundation for Dermatology
- **The International Foundation for Dermatology**
- **The International League of Dermatological Societies (ILDS)**
- **Centers for Disease Control and Prevention**