Summary

- Infection with small worms 3 mm long (never seen in the stool) – small intestine
- Transmission by larvae is transcutaneous or oral
- Importance of endogenous re-infection and multiplication, which lead to very long-term infections
- Hypereosinophilia, larva currens with itch, chronic lung problems
- Hyperinfection in immunosuppression with steroids, HTLV-1

Life cycle

The adult female worm is found in the mucosa of the small intestine. Males cannot penetrate the intestinal mucosa and perish. Reproduction is asexual via parthenogenesis (=development of an embryo from an unfertilized egg cell). The females lay eggs after 2-3 weeks, from which larvae are quickly produced. Initially the larvae are described as rhabditiform. These quickly develop into filariform (infectious) larvae. These larvae may:

- either penetrate back into the intestinal mucosa (*Strongyloides* is one of the rare worms which can multiply in the human body).
- or pass to the perianal skin and from there again penetrate the body (auto re-infection). In auto re-infection there is always another lung passage. In this way an infection with *Strongyloides* may persist for a very long time (more than 30 years).
- or pass to the outside world with the faeces. From there after molting, they may go in either of two directions. The larvae either again penetrate the skin of a human (sometimes even via the mouth) or they develop to adult worms in the outside world. They may then via sexual reproduction in their turn lay eggs, from which new larvae develop. The worm can thus survive without a host.

Clinical aspects

Mild infection is generally asymptomatic. In severe infections there may be intestinal discomfort or diarrhoea. During lung passage symptoms may occur depending on the number of larvae. Auto re-infection via the skin may give sometimes rise to significant itching, chiefly peri-anal. Migration of the larvae in the skin leads to itching red swollen lines

(on the rump, arms, face, etc.). These lines may occur anywhere and progress swiftly (up to 10 cm per hour). The swelling is the result of an urticarial reaction to the migrating larva (the larva itself is only 0.2 mm long). These lesion disappear spontaneously a few hours later, to reappear once more at a different site and this rather typical symptom is called “larva currens” (observed at some moment in about 20% of infected individuals).



Strongyloides stercoralis, larva currens. Such recurrent migrating linear urticarial stripes are pathognomonic for infection with this parasite. Copyright ITM

Immune suppression (especially HTLV-1 infection), achlorhydria (low gastric acid secretion), haematological malignancies including lymphoma, nephropathy, transplant patient taking immunosuppression (cyclosporine, tacrolimus), cytotoxic medication but especially the long-term use of systemic corticoids, all increase the risk of hyperinfection. In such cases there is extensive multiplication with spread of the larvae to all organs (including the brain) due to a dysfunction of the Th-2 helper cells. Symptoms include purpura-like skin lesions (initially

often peri-umbilical), severe diarrhoea, pulmonary symptoms (dyspnoea, bronchospasms, bloody sputum) and meningo-encephalitis. Hyperinfection with *Strongyloides stercoralis* may be accompanied by bacterial septicaemia (with usually Gram-negative bacteria). Mixed infection may occur. This probably depends on mechanical damage to the colon wall; adhesion of intestinal bacteria to the outside of migrating larvae and excretion of bacteria from the intestinal system of the parasite. Hyperinfection has a high mortality (75%). In chronic and persistent infection an underlying infection with HTLV-1 or use of glucocorticoids should be considered. There have been fewer hyperinfections in AIDS patients than one would expect at first sight.

Diagnosis

The eggs hatch very rapidly in the intestine and are often not found in a faecal specimen. Larvae are found in the faeces. Often the numbers are not so high and specific concentration techniques, e.g. the Baermann method or modified agar plate method need to be used. In general, the diagnosis of *S. stercoralis* infection is difficult in the tropics as well as in travellers. Larvae can also be detected via duodenal intubation. Differentiation from hookworm larvae is necessary. Eosinophilia is almost always present, except when immune suppression exists. A history of larva currens is suggestive of strongyloidiasis and is enough to start treatment even if no larvae are found in the faeces. In hyperinfection larvae may be found in the sputum or in broncho-alveolar lavage fluid. The sputum must be regarded as infectious. If this sputum is cultured on blood agar, bacterial colonies can be seen which form a curvilinear pattern, reminiscent of a pearl necklace. This follows the migration of a larva on the agar plate, with translocation of the bacteria.

PCR on a stool sample is the most sensitive test, but is not widely available.

An ELISA test detecting IgG to filariform larvae in serum, can be used in immunocompetent hosts.

However ELISA results can be falsely negative in immunocompromised hosts and in acute infection (as seen in travellers) during the window period. Cross-reactivity may occur in the presence of other helminth infections. As a whole serology is widely used in travel medicine to diagnose (past) exposure to *Strongyloides* but is almost nowhere available in the tropics.

Treatment

- Thiabendazole was used in the past, but had many side effects. Albendazole (400 mg twice daily for 3 to 7 days) is moderately effective. Mebendazole is not active.
- Ivermectin PO (200 µg/kg single dose) is easy to use and effective and at present is the **first line treatment**. Some experts recommend a second course after 1-2 weeks (an RCT is ongoing to answer this question). If immunosuppression is present, the cure rate with ivermectin is lower, certainly if cortisone has been taken. In such cases, successive courses of treatment should be administered. It should be mentioned that there are parenteral ivermectin formulations for veterinary use. They are not (as yet) registered for use in humans, but anecdotal case reports mention success with them.
- In hyperinfection it is important not to forget to use antibiotics, in view of the risk of severe septicaemia.