Diagnosis and management of helminth infections

There are several endemic worm infections in Australia, enterobiasis being the most common, as well as a variety of exotic species infections that may be seen in returned travellers. Selecting an appropriate anthelmintics to treat a particular infection is important.

DAVID I. GROVE
MD, DSc, FRACP, FRCPA, DTM&H

Professor Grove is Director, Department of Clinical Microbiology and Infectious Diseases, Institute of Medical and Veterinary Science, The Queen Elizabeth Hospital, Woodville, SA.

What are worms? The very word can conjure up visions of any elongated, creeping thing that is not obviously something else. Worms (helminths) are multicellular invertebrates belonging to several phyla in the animal kingdom, but only a minority are parasitic in humans. Helminth infections are a major scourge in some countries, but fortunately they are not a major problem in Australia.

If your patient has worms, he or she most probably has the common threadworm or pinworm, *Enterobius vermicularis*, which is found throughout Australia; however, several other worm infections are endemic in this country (Table 1). Many other species are found in different parts of the world, especially in the tropics, and these may be acquired by Australians travelling overseas – the most important and frequent of these are listed in Table 2. If you suspect such an infection in a returned traveller, the best plan is to refer him or her to your nearest expert in tropical and infectious diseases.

Whether or not a patient has symptoms from a helminth infection usually depends on the number of worms he or she is harbouring, although occasionally it depends on the location of the parasite (as in, for example, the case of a hydatid cyst). What is not commonly realised is that most worms are incapable of multiplying within humans. Thus, one ingested *Ascaris* egg becomes only one adult ascarid, and one hookworm larva results in only one adult hookworm. A person's worm burden is generally proportional to both the intensity of infection (eggs and larvae) in the environment and the amount of time he or she spends in that environment. Furthermore, most worms die within a finite time, usually months or years. Note, however, that *Strongyloides stercoralis* is an important exception to this rule, and is capable of replicating indefinitely within the human host.

IN SUMMARY

- **In Australia, most patients who have worms are infected with the common threadworm, *Enterobius vermicularis*. Pruritus ani is the most common symptom.**
- **Most worms cannot multiply within humans. (Note that *Strongyloides stercoralis* is an exception to this general rule.)**
- ***E. vermicularis* infection is diagnosed by finding eggs deposited on the perianal skin, not in the faeces.**
- **If a patient has enterobiasis, treat the whole family.**
- **Infection with *S. stercoralis* can persist for decades and overwhelming infection may supervene in immunosuppressed patients.**
- **Think of brachylaimiasis in a rural patient with unexplained diarrhoea who may have ingested infected snails.**
- **If you suspect an exotic infection, refer the patient to your nearest expert in tropical and infectious diseases.**

Anthelmintics

The range of anthelmintics in Australia is very limited. The agents that are available are:

- mebendazole (Chemist's Own De Worm Chewable Tablets, Combantrin-1 with Mebendazole, Combantrin-1 with Mebendazole Chocolate Squares, Rid-Worm, Vermox)
- pyrantel (Anthel, Combantrin, Combantrin Chocolate Squares,

Table 1. Key features of important endemic worms in Australia that infect humans

Organism	Geographical distribution	Mode of transmission	Site of infection	Anthelmintics
Ascaris lumbricoides	North-east	Ingestion of eggs in contaminated vegetables, ground fruits or dirt	Small bowel	Mebendazole or pyrantel
Brachylaima cribbi	South	Ingestion of infected snails or contaminated vegetables	Small bowel	Praziquantel
Echinococcus granulosus	Country-wide	Ingestion of eggs from dogs	Tissues	Albendazole
Enterobius vermicularis	Country-wide	Ingestion of eggs contaminating the environment	Large bowel	Mebendazole or pyrantel
Hookworms	North	Skin penetration by larvae	Small bowel	Mebendazole or pyrantel
Hymenolepis nana	North	Ingestion of eggs	Small bowel	Albendazole
Strongyloides stercoralis	North	Skin penetration by larvae	Small bowel, tissues	Ivermectin
Taenia saginata	South-east	Ingestion of worms in undercooked beef	Small bowel	Albendazole
Trichuris trichiura	North-east	Ingestion of eggs in contaminated vegetables, ground fruits or dirt	Large bowel	Mebendazole

Table 2. Key features of some worm infections acquired overseas by Australian travellers

Organism or disease	Geographical distribution	Mode of transmission	Major sites of infection	Major clinical features
Clonorchis/Opisthorchis	Eastern Asia	Ingestion of worms in undercooked fish	Biliary system	Jaundice
Loa loa	West Africa	Biting flies	Skin, eye	Urticaria, conjunctivitis
Onchocerca volvulus	Africa, Central and South America	Biting flies	Skin, eye	Pruritus, dermatitis, visual disturbances
Schistosoma haematobium	Africa	Skin penetration by larvae in water	Bladder	Haematuria
Schistosoma japonicum	East Asia	Skin penetration by larvae in water	Bowel, liver	Urticaria, bowel disturbance, hepatosplenomegaly
Schistosoma mansoni	Africa, South America	Skin penetration by larvae in water	Bowel, liver	Bowel disturbance, hepatosplenomegaly
Taenia solium	Tropics	Ingestion of worms in undercooked pork Ingestion of parasite eggs	Bowel Tissues	Abdominal discomfort Epilepsy (cysticercosis)
Tropical pulmonary eosinophilia	Tropics	Unknown	Lungs	Cough, wheeze, eosinophilia

Combantrin Suspension, Early Bird)
- albendazole (Eskazole, Zentel)
- ivermectin (Stromectol)
- praziquantel (Biltricide).

Mebendazole and pyrantel are both available without prescription from pharmacies, but pyrantel is also listed on the PBS. Two drugs are PBS listed for specified conditions only – albendazole for tapeworm and hydatid infections, and ivermectin for strongyloidiasis and onchocerciasis – but they are active against a wide range of worm infections. Praziquantel requires a prescription and is not PBS-listed; it must be sourced from a private pharmacy at considerable cost or from a hospital.

Anthelmintics are discussed in more detail in Table 3.

Enterobiasis

Enterobiasis is by far the most important worm infection in Australia, and probably affects tens of thousands if not hundreds of thousands of people. Although *E. vermicularis* (threadworm) can infect people of any age, both the frequency and severity of symptoms are probably greatest in young children. Infections are often clustered in families. Female worms, about 1 cm long, usually pass out of the anus at night and deposit eggs on the perianal skin. Most infected individuals are asymptomatic, although a few complain of a perianal itch and infants may become irritable, especially at night. Sometimes the worms may be seen crawling on the skin, especially in the perianal area (Figure 1a).

Since eggs are rarely found in faeces, the diagnosis is best made by applying adhesive tape to the perianal skin in the morning before a shower or bath and then examining the tape under a microscope for eggs (Figure 1b). Each female worm produces about 10,000 eggs per night and these may remain viable for a week or so. It is advisable to treat other family members as well as the index case and to repeat the course in two to three weeks.

Mebendazole and pyrantel are both effective in treatment, although neither is advised in pregnancy for this condition. Simultaneous sanitary measures such as showering in the morning, cutting fingernails, washing clothes and bedding, and vacuuming rooms may reduce the chances of reinfection.

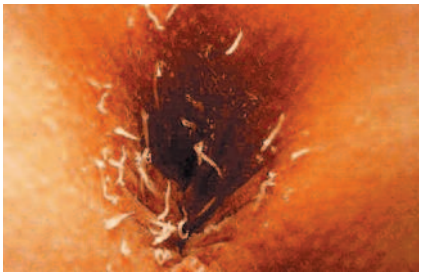

Figure 1a. *Enterobius vermicularis* adult worms in the perianal region.

Figure 1b. The egg of *Enterobius vermicularis*. These are deposited on the perianal skin.

Ascariasis

Ascaris lumbricoides (roundworm) is endemic in Queensland and the Northern Territory, and is more common in Aboriginal communities. Adult worms are 15 to 35 cm long and live in the lumen of the small intestine. Most people who have small numbers of worms are either asymptomatic or have poorly defined abdominal discomfort. A bolus of worms may cause intestinal obstruction, especially in young children. Eggs are plentiful and the diagnosis can be made easily by finding ova in stools (Figure 2). Mebendazole and pyrantel are effective in treatment.

Table 3. Anthelmintics used to treat endemic worm infections

Indication	Anthelmintic	Age	Dose	Duration
Enterobiasis	Mebendazole	≥ 2 years*	100 mg†	Single dose, repeat in 2 weeks
	Pyrantel	All ages	10 mg/kg	Single dose
Ascariasis	Mebendazole	≥ 2 years*	100 mg twice daily†	3 days
	Pyrantel	All ages	10 mg/kg	Single dose
Trichuriasis	Mebendazole	≥ 2 years*	100 mg twice daily†	3 days
Hookworm infections	Mebendazole	≥ 2 years*	100 mg twice daily†	3 days
	Pyrantel	All ages	10 mg/kg	Single dose
Strongyloidiasis	Ivermectin	≥ 5 years*	0.2 mg/kg	Single dose
Tapeworm infections	Albendazole	≥ 2 years*	400 mg daily†	3 days
Echinococcosis	Albendazole	≥ 2 years*	12 mg/kg daily	1 to 6 months
Brachylaimiasis	Praziquantel	All ages	20 mg/kg daily	3 days

* The benefits and risks of treatment in pregnancy and early childhood have to be assessed for each individual patient. † Same dose for children and adults.

Trichuriasis

Trichuris trichiura (whipworm) is endemic in northern and north-eastern Australia, especially among Aborigines. The adult worms, 3 to 5 cm long, attach to the mucosa of the large intestine. Most people are asymptomatic, but diarrhoea, abdominal pain and rectal prolapse may occur in those with very heavy infections. The diagnosis is made easily by finding eggs in the stools or by observing the adult worms on endoscopy. Mebendazole, but not pyrantel, is effective in treatment.

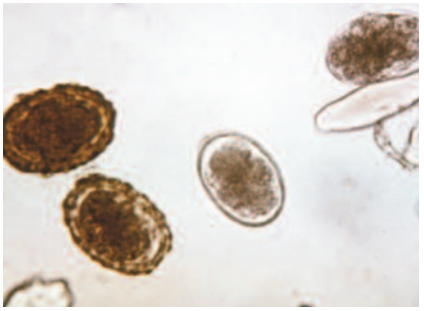

Figure 2. Eggs of hookworm (thin-walled) and *Ascaris lumbricoides* (thick-walled) in a faeces specimen taken from a patient with a mixed infection.

Figure 3. Larva currens, the pathognomonic urticarial rash of strongyloidiasis.

Hookworm infections

Ancylostoma duodenale and *Necator americanus* are endemic in northern Australia, especially among Aborigines. The adult worms, about 1 cm in length, attach to the mucosa of the small bowel and suck blood. Most people have low worm burdens and are asymptomatic, but patients who have heavy infections or marginal nutrition may have an iron-deficiency anaemia and hypoalbuminaemia. The diagnosis is made easily by finding eggs in the stools (Figure 2). A blood eosinophilia often gives a clue to the presence of infection. Mebendazole and pyrantel are both effective in treatment, but iron and protein supplements may also be necessary in malnourished individuals.

Infection with the dog hookworm, *Ancylostoma caninum,* occurs in north-eastern Australia. It causes eosinophilic enteritis manifested by abdominal pain, and responds to treatment with mebendazole. Early diagnosis is important because it may spare the patient a laparotomy, but unfortunately eggs do not appear in the faeces.

Strongyloidiasis

Strongyloides stercoralis is endemic in northern Australia and is also prevalent in immigrants from Indochina. An important biological characteristic of this worm is its capacity to autoinfect (replicate within the human host), therefore infection may persist for many years after acquiring the infection. Adult worms, 2 to 3 mm long, live in the small bowel mucosa, but larvae migrate through the tissues. Many patients are asymptomatic, but others complain of diarrhoea, pruritus ani and urticarial rashes. Some notice crops of stationary wheals, especially on the buttocks or around the waist, while others have larva currens (Figure 3). Intestinal obstruction, septicaemia and meningitis may supervene in immunosuppressed patients in whom excessive multiplication of worms occurs.

Larvae are often sparse in faeces so laboratory diagnosis may be difficult but a positive antibody test result against *Strongyloides* may be helpful. The usual treatment is ivermectin, but unfortunately this does not always eradicate the parasite and immunosuppressed patients may require repeated short courses at monthly intervals to suppress the worm load.

Tapeworm infections

Taenia saginata infection occurs sporadically in parts of Australia, particularly in the eastern States. Adult worms are found in the small intestine and can be up to 3 to 5 m in length (Figure 4). Most patients are asymptomatic, although some may have abdominal discomfort. The diagnosis is made by finding eggs on microscopic examination of faeces or when the patient passes white, motile proglottids (sexual segments of adult tapeworm) in the stools.

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Figure 4. The beef tapeworm, *Taenia saginata,* is contracted by ingesting raw or undercooked beef. The tail is the thick end of the worm.

Figure 5. A chest x-ray of a man with multiple pulmonary hydatid cysts.

Figure 6a. European snails (*Theba pisana* and *Cernuella virgata*) infected with *Brachylaima cribbi* infest areas of southern Australia.

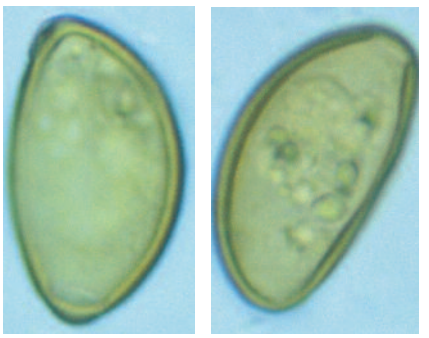

Figure 6b. Infertile (left) and fertile (right) eggs of *Brachylaima cribbi*.

Hymenolepis nana (dwarf tapeworm) is a small tapeworm about 2 to 4 cm long that lives in the small intestine. Most patients are asymptomatic and the infection is diagnosed incidentally on faecal microscopy.

Both these infections may be treated satisfactorily with either albendazole or praziquantel, although the latter (which may be more effective) is not approved for this use in Australia.

Hydatid disease

Cysts of *Echinococcus granulosus* are very slow growing and vary in size up to 20 cm in diameter. Infections occur sporadically around Australia, particularly in farming districts. Many patients are asymptomatic, with the cysts being shown incidentally by imaging procedures. Symptoms are protean, depending on the size and location of the cyst or cysts; most are found in the liver, with the lungs being the organ next most frequently affected (Figure 5).

Serological tests may assist in making the diagnosis, but the infection is only confirmed by excision of the cyst and histology. Cysts should not be aspirated. Surgery, if possible, is the definitive treatment. Albendazole is often given over a short term as an adjunct to surgery, or for a number of months if surgery is not feasible.

'Snail diarrhoea' – brachylaimiasis

Recently, a dozen South Australians who live in rural areas have been found to be infected with a newly described trematode, *Brachylaima cribbi*. This infection is acquired by ingesting infected introduced European snails that infest large areas of southern Australia (Figure 6a). Most patients have been toddlers who have eaten snails or adults who have inadvertently consumed snails or snail parts with home-grown fresh vegetables. Infection causes persistent diarrhoea and abdominal discomfort, as well as failure to thrive in young children. The diagnosis is made by finding the characteristic eggs in faeces (Figure 6b). Treatment with praziquantel is effective.

Conclusion

Worm infections in Australia most commonly involve the common threadworm, which is found throughout the country. However, several worm infections are endemic in this country, and different anthelmintics are useful in treating the different infections. Returned travellers from overseas may have acquired an infection by an exotic worm species – such patients should be referred to an expert in tropical and infectious diseases. MT

DECLARATION OF INTEREST: None.