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Fifteen-minute consultation: Threadworm in children

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INTRODUCTION

Enterobiasis ('threadworm', 'pinworm') is likely the most common parasitic infection, with an estimated 1 billion people infected worldwide.[1] Up to 30% of children globally are affected.[2] The causative parasite is the nematode (roundworm), *Enterobius vermicularis*, transmitted via the faeco-oral route. Gravid adult females migrate from the gastrointestinal tract to lay eggs on perianal folds, usually at night. The eggs become infectious within 4–6 hours. Infection occurs via autoinfection (transfer of eggs to the mouth through hands that have scratched the perianal area) or from exposure to egg in the environment (ie, bed sheets, clothes). The success of *E. vermicularis* as a parasite lies in the number of eggs produced by a single female (estimated at around 10 000)[3] and the tenacity of the eggs, which can survive for up to 20 days outside the host and have a strong adherence to fingers and fingernails.[4]

There is very little evidence base regarding this ubiquitous parasite, which is often viewed merely as a 'nuisance'. The most common symptoms are pruritus ani and subsequent irritability due to poor sleep, but, as a 1962 paper vividly puts it: "*Other symptoms to which lay people in general attach great value are nose scratching, teeth gnashing, fingernail chewing, nightmares, inattention in school or at home, and agitation*".[5]

Infection, particularly when recurrent, can cause significant distress to families, and threadworm infestation is a common clinical scenario for the general practitioner and general paediatrician.

EPIDEMIOLOGY

Enterobius is most common among children aged 4–11 years. Prevalence estimates vary widely due to heterogeneity in diagnostic techniques and population characteristics, and are likely underestimates due to the asymptomatic nature of the disease. In Europe, reported prevalence in this age group ranges from 4% to 30%[6 7] and up to 50%[8] in some low- and middle-income countries. Populations living in temperate climates appear to be most frequently affected. Some studies suggest that urban populations have higher rates than rural ones,[9] while others report the opposite.[8] Some studies suggest that males are more frequently infected than females.[10]

WHY IS THREADWORM IMPORTANT?

The primary symptom of infection is nocturnal pruritus ani, although up to one-third of infected individuals are thought to remain asymptomatic. Pruritus can lead to sequelae such as nocturnal enuresis, local skin trauma and secondary infection. Frequent nocturnal itching may result in insomnia, contributing to daytime fatigue, poor concentration and irritability. Abdominal pain is sometimes reported. While enterobiasis is not believed to cause poor weight gain, a reduced appetite is occasionally noted anecdotally. Overall, symptoms are poorly studied and largely based on anecdotal reports.

Extraintestinal infection is possible, most commonly in the female genital tract. This can result in vulvovaginitis, which may also be caused or exacerbated by pruritus and resultant scratching, or, more rarely, pelvic or peritoneal granulomas.[11] Female genital tract infection may increase susceptibility to urinary tract infections. There is mixed evidence regarding the potential for *E. vermicularis* to be a causative agent in appendicitis.[12]

Recurrence of infection is common in children and may be so frequent that it gives the impression of a persistent, rather than intermittent, infection (box 1). The psychological impact of threadworm infection is significant yet often overlooked. Unfortunately, stigma remains associated with the infection, and families

Box 1 Case vignette

Molly, aged 8 years, is referred with a history of multiple episodes of threadworm infections, approximately every 3 months over the past 5 years. She has taken mebendazole, but the problem persists. She is now experiencing significant sleep disturbance due to perianal itching, and her mother frequently observes live worms in the perianal area during nighttime inspection with a torch.

1. What questions might you ask?
2. Could the family dog be implicated in transmission?
3. Molly's mother is 6 months pregnant—what can she take when treating the whole family?
4. What is the likely prognosis?

often experience significant psychological distress—particularly in cases of recurrent infection—frequently restricting normal activities to avoid exposure or reinfection. The burden of hygiene measures undertaken can be significant and distressing. Although serious physical morbidity is rare, the psychological and social burdens of infection are high.

DIAGNOSIS

Although clinical history (box 2) is often sufficient to initiate treatment, laboratory confirmation can be helpful—particularly in cases of reinfection or when distinguishing between active infection and postinfective itch. Adult worms may occasionally be seen around the anal area or in pyjamas, especially if inspected at night. Clinical examination can be important, particularly in patients with recurrent symptoms, to exclude important differential diagnoses (box 3). The 'adhesive' test remains a useful method for detecting threadworm eggs. Transparent tape is applied to the perianal area first thing in the morning, before bathing. The tape is then placed on a glass slide and examined under a microscope for the presence of eggs. To maximise sensitivity, the test should be repeated on at least three consecutive days (increasing sensitivity from about 50% to 90%).[13] Perianal swabs taken first thing in the morning on consecutive days can also be used for diagnosis. These diagnostic methods have changed little since the 1960s.[5]

Box 2 Symptoms and signs of threadworm infection

Pruritus ani
Local excoriations±bacterial infection
Difficulty sleeping
Irritability
Dysuria
Nervousness/Restlessness
Loss of appetite
Nocturnal enuresis
Vaginal itching and irritation (vulvovaginitis)

Box 3 Important differentials of threadworm

- Other parasites, that is, roundworm and tapeworm
- Vulvovaginitis
- *Candida* infection, pubic lice
- Skin conditions—contact dermatitis, streptococcal dermatitis, psoriasis, lichen sclerosis
- Gut or systemic disease such as inflammatory bowel disease
- 'Psychological itch'—common post-treated infection
- Delusional parasitoses (usually of parents)

Stool microscopy for ova, cysts and parasites has poor sensitivity for *Enterobius* infection (about 5%).[14] A recent development is the availability of PCR methods for diagnosis, which have much higher reported sensitivity than the adhesive test.[15] However, PCR is not available in many centres worldwide and is rarely accessible to clinicians.

Enterobiasis does not cause eosinophilia.

TREATMENT

Non-pharmacological

Non-pharmacological measures remain key to successful control of threadworm infection, and it is important to emphasise this to families. The measures aim to reduce the shedding and persistence of eggs in the environment and to prevent their oral ingestion. Breaking the cycle of autoinfection is crucial to preventing recurrence (figure 1). Hygiene measures are labour-intensive but can be effective if the entire household adheres to them. Children do not need to be kept off school, but hygiene measures should be reinforced in the school setting.

Personal measures

- Thorough handwashing with soap and warm water after using the bathroom, changing nappies and before eating and handling food.

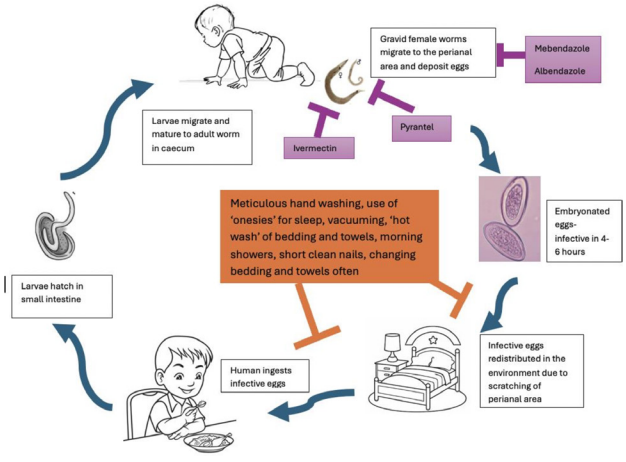

Figure 1 Conservative and pharmacological treatment within the parasite's life cycle.

- Ensure nails are kept short and clean, and brush under them once a day. Avoid nail biting.
- Wash/Shower every morning to remove eggs on skin, including perianal washing.
- Nightwear that discourages scratching, that is, 'onesies'.
- Do not share towels, flannels or co-bathe.

Environmental measures

- Wash sheets and fluffy toys at high temperature (>60°) initially and at least weekly, without shaking prior to washing. Change nightwear daily for first few days following treatment.
- Vacuum bedroom at least weekly, including mattress.
- Change towels and flannels regularly.
- Clean surfaces regularly.

Pharmacological

First-line treatment is with mebendazole (100 mg per dose), which is adulticidal and should be repeated after 2 weeks to target newly matured worms. Mebendazole can be purchased without a prescription and may be used from 6 months of age, although it is only licensed for use from the age of 2.[16] There are no recommended pharmacological options for children under 6 months, so strict nappy hygiene is essential.

Further treatment options include albendazole (licensed from 2 years of age) and pyrantel embonate or pamoate. Treatment must be taken simultaneously by all household members, including sexual partners.

TREATMENT OF RECURRENT THREADWORM

Recurrent threadworm infection can cause great distress to families over months or even years (box 4). In chronic cases, 'psychogenic pruritus' may persist even after the infection has been cured.

The impression of persistent threadworm is most commonly due to recurrence rather than resistance. Efficacy data for commonly used agents are high, reportedly 90%–100% in several studies.[17 18] While drug resistance is commonly suspected in patients who continue to see worms >2 weeks into treatment, there are no data to either confirm or refute this. B-tubulin mutations conferring resistance to mebendazole and albendazole have been widely found in animal nematodes and in some human nematodes; however, these mutations have not been investigated in threadworm.[19]

It is important to ensure that patients receive two doses of treatment, 2 weeks apart, as all drugs have reduced efficacy against immature worms. This is why retreatment is necessary when growing worms reach maturity. Adult worms may be visible between doses and some egg laying may continue. Additionally, it is crucial that all household members are treated, even if asymptomatic, and that hygiene measures are strictly followed. It is helpful to explore whether the child frequently stays elsewhere or if others frequently stay in the house, as this may help identify a source of infection. It is also useful to determine whether the child experiences symptom-free periods after treatment (suggesting that the treatment is effective), or if worms are seen within 2 weeks after the second dose (suggesting that the treatment may be ineffective).

With expert advice, pyrantel or pulsed pyrantel (intermittent dosing over several weeks) may be used in difficult cases (figure 2). Ivermectin may also be used, although efficacy data are more limited and poorer than for other agents,[20] and its side-effect profile may be of concern.

In severe cases, psychology support may be helpful.

Box 4 Answer to case vignette

1. What questions might you ask?
A detailed history including symptoms, who in the family has been affected, any other frequent contacts and hygiene measures and treatments taken to date.
2. Could the family dog be implicated in the transmission?
No, humans are the only hosts of *Enterobius vermicularis*.
3. Molly's mother is 6 months pregnant—what can she take when treating the whole family?
High-quality evidence on the best treatment for pregnant women is lacking, so hygiene measures should be recommended as first-line management. If treatment is required, mebendazole is considered the safest drug, but it should be avoided during the first trimester.
4. What is the likely prognosis?
Most children outgrow enterobiasis by the end of the preschool years, and nearly all by the end of primary school.

WHAT ARE THE GAPS IN KNOWLEDGE AND PRACTICE?

There is limited evidence and data regarding threadworm infection, despite its ubiquitous and recurrent nature. Prevalence is estimated rather than directly confirmed,

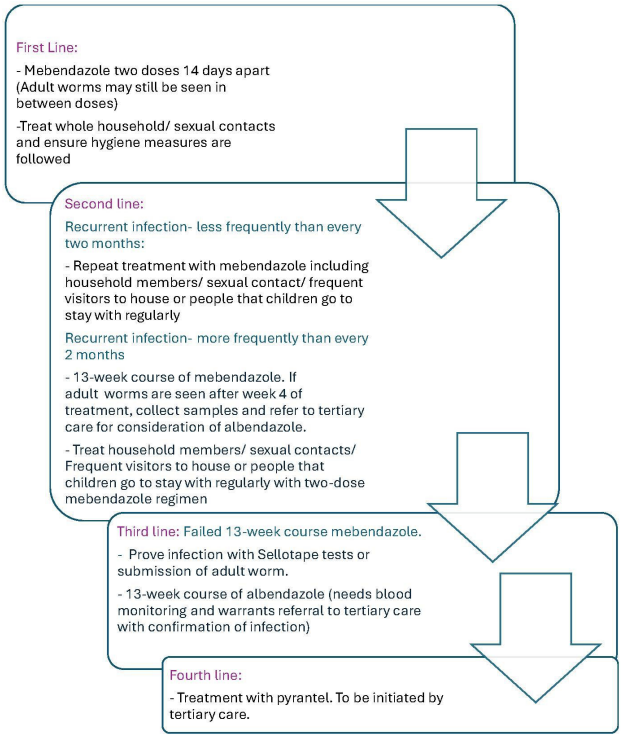

Figure 2 Suggested treatment ladder for enterobiasis.

and non-behavioural host factors influencing infection remain poorly understood. Symptoms have not been formally studied or correlated with laboratory confirmation of infection, and there is little formal evidence to support the strong anecdotal evidence of significant practical and psychological morbidity for affected families.

More sensitive and less labour-intensive diagnostic tools are needed than the current standard of the 'adhesive test'. Although there is significant experience with common agents used to treat enterobiasis, formal efficacy studies are lacking, and no evidence-based guidelines exist. The role of treatment resistance in human enterobiasis is poorly understood.

While often regarded as a mere 'nuisance', enterobiasis is a ubiquitous neglected infection that causes a significant societal burden. Research is needed into improved diagnosis, treatment and population-level control.

Clinical bottom line

- Enterobiasis is highly prevalent in children aged 4–11 years, with rates reaching up to 30% in the UK.
- It causes a significant burden for families, despite being considered 'non-serious'.
- Treatment should follow a stepwise approach, with adherence to non-pharmacological hygiene measures remaining essential.
- 'Persistence' is usually due to recurrence rather than resistance.
- The re-infection cycle must be broken through strict adherence to hygiene measures and treatment of the whole family.

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