

Indian Academy of Pediatrics (IAP)



# STANDARD TREATMENT GUIDELINES 2022



## Common Worm Infestations

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# Common Worm Infestations

125

## Introduction

- ☑ Worms or helminths are multicellular organism of the phyla Nematelminthes (roundworms) or Platyhelminthes (flatworms).
- ☑ Common ones include roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), hookworms (*Ancylostoma duodenale* and *Necator americanus*), tapeworms (*Taenia saginata* and *Taenia solium*), *Echinococcus* and pinworm (*Enterobius vermicularis*).
- ☑ Nearly one-fourth of the world's population is known to be affected by worms particularly affecting the children from the low- and middle-income countries.
- ☑ Based on pooled data of 127 surveys in India, worm infestation prevalence is found to be over 20% and hence the World Health Organization (WHO) classified India as moderate risk area.
- ☑ Ministry of Health and Family Welfare study across the country shows varied picture with prevalence ranging from 12.5 to 85%. Studies show *Ascaris* is most common infestation (52%), followed by hookworm (42%) and whipworm (5%).

## Clinical

General	Most cases with intestinal worm infestation are mild and asymptomatic. Symptoms are generally associated with moderate to heavy infestations include growth retardation or faltering, nutritional compromise, and suboptimal academic performance. Nutritional deficits are due to diversion of nutrients and associated anorexia and enteropathy.	
Roundworm ( <i>Ascaris lumbricoides</i> )	Pulmonary	<i>Löffler's syndrome</i> : Sudden onset of wheezing, dyspnea, paroxysmal nonproductive cough, and fever, pulmonary infiltrate on chest X-ray, and peripheral blood eosinophilia
	Intestinal	Abdominal pain, distension, nausea, and episodic diarrhea. Occasionally, gut obstruction, impaction, intussusception, perforation, and hepatobiliary complications
	Allergic	Rash, angioedema, and abdominal pain and vomiting

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## When to Suspect Worm Infestation?

When to Suspect Worm Infestation?

Clinical

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Hookworm ( <i>Ancylostoma duodenale</i> and <i>Necator americanus</i> )	Skin	Ground itch—papulovesicular dermatitis at the site of entry of larva
	Allergic	Eosinophilia and urticarial rash
	Acute	Abdominal pain
	Chronic	Anemia (blood loss 0.03 mL/worm/day) and edema (protein loss)
Whipworm ( <i>Trichuris trichiura</i> )	Abdominal	<i>Trichuris</i> dysentery syndrome, characterized by inflammation, tenesmus, straining and rectal prolapse, and colitis
	Systemic	Anemia and growth retardation with heavy infection
Tapeworm ( <i>Taenia saginata</i> and <i>solium</i> )	Abdominal	Abdominal discomfort, pruritus ani, and perianal itching sometimes
	Psychological	Distress after seeing proglottids in stool and undergarments
Pork tapeworm larva ( <i>Taenia solium</i> )	Neuro-cysticercosis	<i>Seizures</i> : Usually focal, sometimes generalized (parenchymal). Obstructive hydrocephalus (intraventricular). Communicating hydrocephalus (subarachnoid). Radiculitis, transverse myelitis (spinal). Decreased vision, vitreous and retinal detachment (ocular)
<i>Echinococcus</i> ( <i>E. granulosus</i> )	Abdominal	Pain, vomiting, progressive distension, mass, and Hepatomegaly
	Pulmonary	Chronic cough, chest pain, and hemoptysis
	Brain	Mass effects
	Anaphylaxis	With cyst rupture or spillage
<i>E. multilocularis</i>	Almost always involve liver. Very slowly growing and rare in children	
Pinworm ( <i>Enterobius vermicularis</i> )	General	Irritability and sleeplessness
	Pruritus ani	Perianal itching

**Fecal Examination**

Stages of helminths found in stool are egg and larva, though whole adult worm or segments of worm may also be seen. Demonstration of eggs in stools for *Ascaris*, *Ancylostoma*, *Necator*, *Trichuris*, and proglottids for taeniasis may be undertaken. Most infections due to *Ascaris* can be easily diagnosed on microscopic examination since an average female worm produces an average of 200,000 eggs per day. Most recommended procedure is formalin-ether method. Other less common techniques are zinc sulfate floatation technique and saturated sodium chloride floatation technique. If the number of eggs/larvae is low in feces, then the stool sample can be concentrated.

For *Enterobius* infections ova can be detected in perianal region as the female worm comes out of intestinal tract to oviposit in the perianal area. Eggs are usually found in the folds of skin around anus and rarely appear in stool. Thus perianal swab or cello tape may be used for recovery of eggs.

Blood	Blood examination for eosinophilia and microscopic, hypochromic anemia may indicate helminthiasis.
Molecular tests	Polymerase chain reaction (PCR) is a newer technique for the detection of several parasitic infections. Advantages are improved sensitivity particularly when eggs are below the detection limit for microscopy, higher diagnostic yield for multiple helminths in a sample and the ability to quantify egg burden. Problem with currently available molecular test is the nonavailability of standardized commercial kits.
X-ray	X-ray may show radiolucent shadow in intestinal obstruction due to ascariasis in the form of <i>cigar-bundle appearance</i> due to bunch of worms together. <i>Whirlpool effect</i> is due to contrast of mass of worms against intestinal air on plain radiograph.
Ultrasonography (USG)	<p>Direct visualization of worms is possible on ultrasound (US).</p> <ul style="list-style-type: none"> <li>☑ Locate roundworm in cases presenting as intestinal obstruction or biliary colic.</li> <li>☑ Coiled body of <i>Ascaris</i> in biliary tract gives a classic end on image on US called <i>bull's eye sign</i> or <i>double tubes sign</i>.</li> <li>☑ Detect and localize hydatid cysts present in liver, brain, kidney, bone, and other viscera. The WHO staged hydatid cyst in five stages as stage I–V. Stage I and stage II are early stages and stage IV and stage V are late stages of disease.</li> </ul>
CT/MRI	CT scan and MRI may be required as additional examinations for cysticercosis and hydatid cyst cases.

Anthelmintic drugs are classified as:

- ☑ *Benzimidazoles*: They bind to beta tubulin, inhibit microtubule formation leading to damage to the cells of nematodes, e.g., mebendazole and albendazole. Albendazole, in addition has ovicidal and larvicidal effects also.
- ☑ *Cause spastic paralysis*: Due to their acetylcholine receptor agonist activity. It includes pyrantel pamoate and levamisole.
- ☑ *Cause flaccid paralysis*: Being gamma-aminobutyric acid (GABA) agonist they reversibly inhibits neuromuscular transmission in the worm, e.g., piperazine.  
Need to change causing spastic paralysis and flaccid paralysis in classification.

<b>Roundworm (<i>Ascaris lumbricoides</i>)</b>	
Intestinal	<i>Albendazole</i> 400 mg PO once (200 mg below 2 years) or <i>mebendazole</i> 100 mg twice daily PO × 3 days or 500 mg once or <i>ivermectin</i> 150–200 µg/kg PO once. Ivermectin should not be administered to pregnant or lactating women and its safety in children <15 kg is not known. <i>Nitazoxanide</i> 100 mg PO twice daily for 3 days for children 1–3 years of age. Dose is 400 mg in 4–11 years and 500 mg in adolescent and adults in same schedule shows same efficacy as single dose albendazole.
Intestinal obstruction	Treatment of choice is <i>piperazine citrate</i> 75 mg/kg/day for 2 days (maximum 3.5 g/day) by nasogastric (N/G) tube. In severe cases surgery may be needed.
Pulmonary	None of anthelmintics has documented efficacy. Symptoms are usually self-limiting and are treated symptomatically.
<b>Hookworm</b>	
<i>Albendazole</i> 400 mg PO once (200 mg below 2 years) or <i>mebendazole</i> 100 mg PO bid × 3 days or 500 mg once or <i>pyrantel pamoate</i> 11 mg/kg base (maximum 1 g) PO daily × 3 days. Hookworm eradication sometimes require multiple doses and <i>N. americanus</i> are sometimes more refractory to treatment. Cure rate with single dose mebendazole are sometimes as low as 10% or less.	
<b>Whipworm (<i>Trichuris trichiura</i>)</b>	
<i>Albendazole</i> 400 mg PO × 3 day (drug of choice) or <i>mebendazole</i> 100 mg PO twice daily for 3 days or <i>ivermectin</i> 200 µg/kg/d PO × 3 days. Cure rate with single day treatments are low and short lived (28–36%).	
<b>Tapeworm adult</b>	
<i>Praziquantel</i> 25 mg/kg PO once or <i>niclosamide</i> 50 mg/kg PO once in children, 2 g for adults. <i>Nitazoxanide</i> is sometimes effective. Treatment with polyethylene glycol bowel preparation can increase fecal yield of scolices.	
<b>Pork tapeworm larva (<i>Taenia solium</i>)</b>	
Larval stage of beef tapeworm ( <i>Taenia saginata</i> ) does not cause human disease. Pork tapeworm larva ( <i>Taenia solium</i> ) cause cystic lesions in tissues called cysticercosis. Initial management of cysticercosis including neural disease is symptomatic and supportive including treatment of seizures with standard antiepileptics, treatment of hydrocephalus, etc. If lesions resolve antiepileptics may be tapered and stopped. Recurrent seizures or calcified lesions which are risk factors for recurrent seizures need prolonged or lifelong antiepileptic therapy.	
Parenchymal	Lesions resolve spontaneously with or without treatment but the process is usually prolonged. Antiparasitic therapy leads to speedier resolution of solitary cyst, decrease in frequency of recurrent seizures. Corticosteroid also is also likely to decrease seizure frequency.

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	Most commonly used drug is albendazole 15 mg/kg/day PO in two divided dose. It is absorbed better when taken with fatty meals. For single lesion usual duration of therapy is 7 days. For multiple lesions or subarachnoid type, higher dose (30 mg/kg/day) or longer duration or combination therapy with praziquantel is often needed. Praziquantel in doses of 50–100 mg/kg/day for 28 days may be used in combination with albendazole or as an alternative to it. Prednisone (1–2 mg/kg/day) or dexamethasone (0.15 mg/kg/day) should be given before first dose of antiparasitic drug and should be continued for at least 2 weeks.
Obstructive	Most need neurosurgical measures. Though some patients need emergent placement of ventriculostomy. Majority are treated with cystectomy. Minimally invasive approach with neuroendoscopy is favored currently.
Subarachnoid	Prognosis is usually poor. Need aggressive treatment with antiparasitic and anti-inflammatory therapy, which are usually prolonged, coupled with neurosurgical interventions like ventriculoperitoneal shunt (VPS) placements.
Ocular	Treated with medical and surgical interventions.

***Echinococcus (E. granulosus)***

Management includes medical, percutaneous, aspiration, instillation, and reaspiration (PAIR), and surgery and depend on stage of disease and location of cyst.

Medical	Indicated in: <ul style="list-style-type: none"> <li>☑ Early stages (stage I and 3A) and size &lt;5 cm diameter</li> <li>☑ Where PAIR and surgery are contraindicated</li> <li>☑ With PAIR prophylactically for 1 week before and 1 month after PAIR</li> </ul> Albendazole given alone (15 mg/kg/day PO in two divided dose for 1–6 months, maximum 800 mg/day). Adverse effects include leukopenia, gastrointestinal (GI) disturbances, elevated liver enzymes, and occasional alopecia. Blood counts should be done at the beginning and every 2 weeks.
PAIR	Indicated in larger lesions in stage I and 3A. US or CT-guided PAIR with prophylactic albendazole show similar efficacy than surgery and lesser side effects. Contraindicated in pregnancy and bile staining cyst indicating biliary fistula.
Surgery	Indicated in: <ul style="list-style-type: none"> <li>☑ Stage II and 3B</li> <li>☑ Complicated cysts such as ruptured cyst, cyst with biliary fistula, large pulmonary cyst, and cyst of bones and brain</li> </ul> Prophylactic albendazole is given like PAIR but sometimes combined with praziquantel for prolonged duration up to 3 months postoperative.
Watchful waiting	Stage IV and stage V do not require immediate treatment and are followed up with periodic US for resolution or reactivation.

***Pinworm (Enterobius vermicularis)***

Albendazole 400 mg PO once; repeat in 2 weeks or mebendazole 100 mg PO once; repeat in 2 weeks or pyrantel pamoate 11 mg/kg base three times in 1 day PO (maximum 1 g); repeat in 2 weeks. Morning bathing removes a large portion of egg. Frequent change of underclothes and bedclothes decrease risk of auto infection.

Spread of worm infections can be prevented or reduced by improving hygiene, including:

- ☑ Washing hands, particularly before eating and after using toilets
- ☑ Using sanitary latrines
- ☑ Wearing slippers
- ☑ Drinking safe and clean water
- ☑ Eating properly cooked food
- ☑ Washing vegetables, fruits, and salads in safe and clean water
- ☑ Keeping nails clean and short

In low-risk areas with <20% infection rate in community, the WHO does not recommend individual screening, since the cost of screening is four to 10 times that of the treatment and individualized treatment is recommended. Treatment is recommended once a year when the prevalence of infections in the community is over 20%, and twice a year when the prevalence of infections in the community exceeds 50%.

- ☑ To combat this issue, in 2015 the Government of India launched the fixed-day anganwadi and school-based National Deworming Day to deworm all children aged 1–19 years. The National Deworming Day is conducted in all states/union territories (UTs) on February 10 every year, with a mop-up day on February 15. Some states/UTs also conduct a biannual round on 10 August, depending on worm prevalence in their state/UT.
- ☑ Albendazole is used by the Government of India and is a safe treatment for intestinal worms used across the globe. The recommended dosage for children between the ages of 2 and 19 is 1 tablet (400 mg) and for children between the ages of 1 and 2 is half tablet (200 mg). For young children the tablets should be broken and crushed and then to be administered with water.

- ☑ Bharti B, Bharti S, Khurana S. Worm Infestation: Diagnosis, Treatment and Prevention. *Indian J Pediatr.* 2018;85:1017-24.
- ☑ Chan MS. The global burden of intestinal nematode infections—fifty years on. *Parasitol Today.* 1997;13:438-43.
- ☑ de Silva NR, Brooker S, Hotez PJ, Montresor A, Engels D, Savioli L. Soil-transmitted helminth infections: updating the global picture. *Trends Parasitol.* 2003;19:547-51.
- ☑ Greenland K, Dixon R, Khan SA, Gunawardena K, Kihara JH, Smith JL, et al. The epidemiology of soil-transmitted helminths in Bihar State, India. *PLoS Negl Trop Dis.* 2015;9:e0003790.
- ☑ Health and Family Welfare Department. National Deworming Day. [online] Available from <https://health.tripura.gov.in/?q=de-worming-day>. [Last accessed November, 2022].
- ☑ National Health Mission. National Deworming Day (NDD). Frequently Asked Questions (FAQs) for Deworming School Children—evidence-based. [online] Available from [http://nhm.gov.in/images/pdf/NDD/FAQ/FAQ\\_for\\_NDD-FrontlineWorkers\\_Eng.pdf](http://nhm.gov.in/images/pdf/NDD/FAQ/FAQ_for_NDD-FrontlineWorkers_Eng.pdf). [Last accessed November, 2022].
- ☑ Robert K. Nelson Textbook of Pediatrics, 21st edition. Philadelphia, PA: Elsevier; 2020.
- ☑ World Health Organization. Soil-transmitted helminthiases: eliminating soil-transmitted helminthiases as a public health problem in children: progress report 2001–2010 and strategic plan 2011–2020. Geneva, Switzerland: World Health Organization; 2012.