

# ***Enterobius vermicularis* cause of acute appendicitis in a child with Acute Lymphocytic Leukemia: A Case Report**

**Running title:** Enterobius vermicularis-Induced Appendicitis in a Child with ALL

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## Abstract

**Background:** *Enterobius vermicularis* is the most important intestinal parasite in children worldwide. When this parasite migrates unexpectedly, the larvae move out of the intestine and enter organs such as the appendix and can cause health risks.

**Case report:** An 8-year-old boy was admitted to the oncology clinic of Tabriz Children's Hospital complaining of fever of 39-40°C with abdominal pain, cramps, loss of appetite, weakness and fatigue associated with cervical lymphadenopathy, hepatomegaly, axillary mass, abdominal upper thigh, maculopapular rashes and tiny petechiae on the chest and abdomen.

**Results:** On CT examination of the chest, moderate mediastinal and mesenteric lymphadenopathy was noted. The patient was hospitalized with a definitive diagnosis of acute lymphoblastic leukemia (ALL). On the seventh day of hospitalization, the patient developed additive colic pain (Contraction and cramping) around the umbilicus and concomitantly developed pain downward and rightward into the abdomen. Based on the clinical findings, the patient was thought to have acute appendicitis. Pathological examinations showed that *E. vermicularis* was the cause of the appendicitis.

**Conclusion:** The results of this study indicate that this parasite may be associated with inflammation of the appendix in patients with acute lymphoblastic leukemia. A screening program is still required in patients with immunodeficiency or those taking immunosuppressive drugs.

**Keywords:** *Enterobius vermicularis*, Oxyuris, Appendicitis, Acute Lymphocytic Leukemia

## Introduction

*Enterobius vermicularis* (Oxyuris- *E. vermicularis*) is one of the most common worm infections in humans, which can be asymptomatic or symptomatic (1, 2). This parasite can cause infections in up to 20% of children (3-5) and can cause appendicitis in up to 4% (4, 6-8). This worm is a common cause of parasitic infections in young children (5-10 years) living in confined spaces or in nurseries (9). This infection may cause some symptoms in patients, such as anal itching, moodiness, perianal itching, inflammation of the urethra and vagina, insomnia, whimpering, weight loss, and malaise (2). However, one-third of infections do not present with symptoms (2). It is estimated that 200 million people are infected worldwide, including 30-40 million in the United States and Canada (10). The life cycle of adult *E. vermicularis* is 3-6 weeks, so drug treatment with perfect hygiene can stop the infection cycle (10). *E. vermicularis* normally lives in the terminal ileum, cecum, vermiform appendix, and proximal part of the colon (11). After fertilization, the female worm migrates to the anus, where oviposition occurs (at night), while the male worm dies (11). Intolerable scratching transfers the eggs to the fingers, and after contamination of the hands, the eggs may enter the mouth, the larvae are released at the beginning of the small intestine and continue their journey toward the appendix, and the worm begins to multiply again (11). In more than 80% of cases in children, anal itching is due to contamination with the parasites (12). When eggs and lifeless parasites enter ectopic sites, granulomas and abscesses may develop (13). *E. vermicularis* has been poorly detected in the vagina, uterus, and fallopian tubes because the female worm moves around to lay eggs, so this worm sometimes causes vaginitis (10). Scotch tape test is the standard golden method to detect this worm infection (2). For many years, the relationship between *E. vermicularis* and appendicitis has been studied, but the relationship between this worm and inflammation is still unknown. Aschoff offered that this parasite causes signs similar to true appendicitis or appendiceal colic (11). For the first time, *E. vermicularis* was described in the appendix by Fabrius in 1634 (11). In addition, the incidence of appendiceal infections caused by *E. vermicularis* has been reported to range from 0.65% to 4.1% (4, 7, 8, 14, 15). This nematode normally lives in the lumen of the appendix. (16). *E. vermicularis* infections have been shown to be more associated with chronic inflammation (8.3%) of infected appendixes compared to appendixes without pathological changes (7.0%) or with acute inflammation (0.5%) (4).

## Case report

The patient was an 8-year-old boy living in Miandoab, West Azerbaijan, Iran. He was admitted to the oncology department of Tabriz Children's Hospital complaining of fever of 39-40°C with crampy abdominal pain, loss of appetite, weakness, and fatigue associated with cervical lymphadenopathy, masses in the axillae, thighs, and maculopapular rashes, and tiny petechiae on the chest and abdomen, which were found to be hepatosplenomegaly on clinical examination. In laboratory tests, the patient's biochemical and haematological values were as follows (Table 1).

**Table 1.** Results of clinical and laboratory parameters

Parameters	Clinical & Laboratory Parameters	Parameters	Clinical & Laboratory Parameters
LDH	1430 U/ml	Creatinine	0.6 mg/dl
ESR	95 mm/h	BUN	23 mg/dl
SGOT	32 U/ml	WBC	1300/mm <sup>3</sup>
SGPT	28 U/ml	Hemoglobin	9.2 g/dl
Uric acid	3.1 mg/dl	Platelets	67000 U/l
Sodium	111 mmol/L	Lymphoblast	90%
Potassium	4.1 mmol/L	Eosinophil	3%

Urine analysis and urine culture were normal. On chest radiography, the mediastinum was wide. Medium mediastinal lymphadenopathy was noted on CT chest radiography. Ultrasonographic examination of the abdomen measured the liver and spleen to be 147 mm and 110 mm, respectively, and concomitant aortic and mesenteric lymphadenopathy was noted. Lymphoblastic cells showed up to 90% and in flow cytometric examination of bone marrow. CD13, CD10, CD19, CD33, CD22 was negative and CD7: 83%, CD3: 70% and HLA-DR was 70%. The patient was hospitalized with a definitive diagnosis of acute lymphoblastic leukemia. On the seventh day of hospitalization, the patient developed vomiting and anorexia and also developed colic pain (contraction and cramps) around the umbilicus and concomitant pain in the lower and right abdomen. Clinical examination revealed right iliac fossa (RIF) tenderness on palpation and rebound tenderness on release. On examination of the right abdomen and lower abdomen, generalized abdominal pain was present (indicating spread of inflammation to the peritoneum). Based on the signs and laboratory findings, a diagnosis of acute appendicitis was considered for the patient, who underwent surgery. After consultation with the oncologist of the ward and in agreement with the surgeon, the child underwent appendectomy. Because the history on admission to the hospital noted excessive night sweating with anal itching and scratching and increased salivary secretions, the patient was examined with the scotch tape test. On clinical examination, erythematous lesions were noted on the skin around the anus and perianal erythema. In the pathological sections of the appendix, acute inflammation of the appendix was observed along with the cross-section of an adult female *E. vermicularis* with morphological features such as a uterus containing eggs and the presence of cephalic alae in the head region of *E. vermicularis* (Figure 1). The patient with a final diagnosis of enterobiasis was treated with mebendazole at a dosage of 100 mg twice daily for 3 days, which decreased the gastrointestinal symptoms and anal itching and also improved the patient's general condition. After surgery, the patient was treated with intravenous 400 mg clindamycin, intravenous 500 mg ceftazidime, and clindamycin tablets 400 mg every 12 hours for 4 days. During drug induction, the patient was treated with 60 mg prednisolone as a single dose and 1.5 mg/m<sup>2</sup> IV vincristine over one minute per week for 5 times and also the patient received doxorubicin 45 mg/m<sup>2</sup> on the first day. After injection of 6000 IU/m L-asparaginase on the ninth day, the patient went into remission. With daily 6-mercaptopurine, weekly methotrexate, and monthly vincristine, the patient was discharged in a good and stable general condition.

## Discussion

*E. Vermicularis* is a parasite of the gastrointestinal tract with high prevalence in children. Infections caused by *E. vermicularis* can occur worldwide and are considered one of the extremely contagious infectious diseases (17). This disease occurs in all age groups and social and economic classes, but is more common in children aged 5 to 14 years and in areas with poor health (14, 18). Infections caused by this parasite are more common in immunocompromised patients (such as AIDS) or in people taking immunosuppressive drugs (in organ transplantation or autoimmune diseases). For the first time, the presence of enterobiasis in the appendix lumen was reported in the late 19th century (1899) (19). In some studies, acute or chronic inflammatory findings were observed in appendix specimens containing *E. vermicularis* (14). This parasite infection can cause a clinical picture similar to acute appendicitis due to a hypersensitivity reaction in the tissues (20). According to the worldwide records, Khosh Zaban et al. examined 1590 patients undergoing appendectomy for the presence or absence of *E. vermicularis*. They were infected with parasites in 38 cases (2.39%) and the highest percentage of infections was observed in females aged 0-9

years (21). In a study conducted by Da Silva et al. in Brazilian health centers, 1600 patients who underwent surgical treatment were examined. It showed that 23 cases (1.43%) were infected with parasites and the highest percentage of infections occurred in the male age group of less than ten years (7). Siavoshi and et al. studied 5314 patients who underwent appendectomy in general hospitals in Hamadan and it was found that 66 cases (24.1%) were infected with *E. vermicularis* (22). In 2005, a study was conducted by Yildirim et al. in Adana hospital in which 104 patients that were surgically treated were examined and was determined that 4 (8.3%) cases were infected with pinworm (18). In a study by Isik and colleagues of 890 cases of appendectomy, 18 cases (2%) were infected with *E. vermicularis* (23). Also, in a study by Aydin and et al. conducted in Alanya hospital, 190 cases of appendectomy were studied and it was found that four cases (2.1%) were infected with *E. vermicularis* (24). The highest number of cases of appendicitis infected with parasites (15%) was reported by Hamdona et al. 2016 in Palestine (19). According to Gutierrez (2000), a statistically significant association between *E. vermicularis* infection and urinary tract infections has been demonstrated (25). However, Burkhardt (2005) claims that the incidence of *E. vermicularis* as a cause of urinary tract infections has not yet been proven. (26). In addition, one report indicated that 36% of young girls with a UTI also had painful urination associated with that infection (26). The association between enterobiasis and appendicitis has been documented, but there is no clear consensus on this issue: while Gutierrez (2000) claims that there is a consensus that *E. vermicularis* cannot cause inflammation of the intestine. (25). Cook believes that appendicitis is caused by this worm (27) and Burkhardt (2004) states that infection with *E. vermicularis* causes symptoms of appendicitis (26). Hamood reported a case of acute appendicitis caused by *E. vermicularis* in a 23-year-old housewife from Iraq in 2019. *E. vermicularis* can colonize the appendix and cause symptoms with or without actual histopathological acute appendicitis (28). The belief that *E. vermicularis* infestation can cause diseases such as acute or chronic appendicitis or perforation of the appendix has been documented (29). However, there are also reports of completely asymptomatic patients (30). All these cases prove that there is a connection between the inflammation of the appendix and even acute lymphoblastic leukemia (ALL), which is also due to the weakening of the immune system in these cases. Based on the results of previous studies and the importance of this parasite due to its effects on growth, health, nutritional status and cognitive development (especially in children), it is proposed that in order to control and prevent the disease, families should be given the necessary information about the life cycle, transmission and prevention of infection with enterobiasis. In addition, since the infection caused by this parasite is easily transmissible, training should be provided to individuals and personal and public health care should be improved to avoid the risk of infection with the parasite. Basic measures should also be taken to improve the economic situation of people. It is also recommended to consider public and private health promotion through education

## Conclusion

According to the results of this report and other studies on this subject, it has been established that infection with this nematode may be associated with inflammation of the appendix or acute lymphoblastic leukemia. This is also true in cases where the immune system is weakened (e.g., in AIDS or congenital immunodeficiency syndromes) or when taking immunosuppressants (special drugs for organ transplants). Therefore, a pinworm screening program remains necessary for immunocompromised patients or those receiving immunosuppressive medications.

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This study did not receive any funding.

## Conflict of interest

The authors declare that we have no conflict of interest.

## Ethical statements

Because this manuscript is an unusual case report that does not violate the principles of ethics, ethical certification was not required. Therefore, the results of the information were published in accordance with the principle of confidentiality.

## Authors' contribution

Case report, AR and SHGH; data collection, FA, MKH, and AR; data analysis, MKH; draft manuscript, MKH; intellectual contribution and manuscript revision, MKH. All authors read the manuscript and approved its final version.

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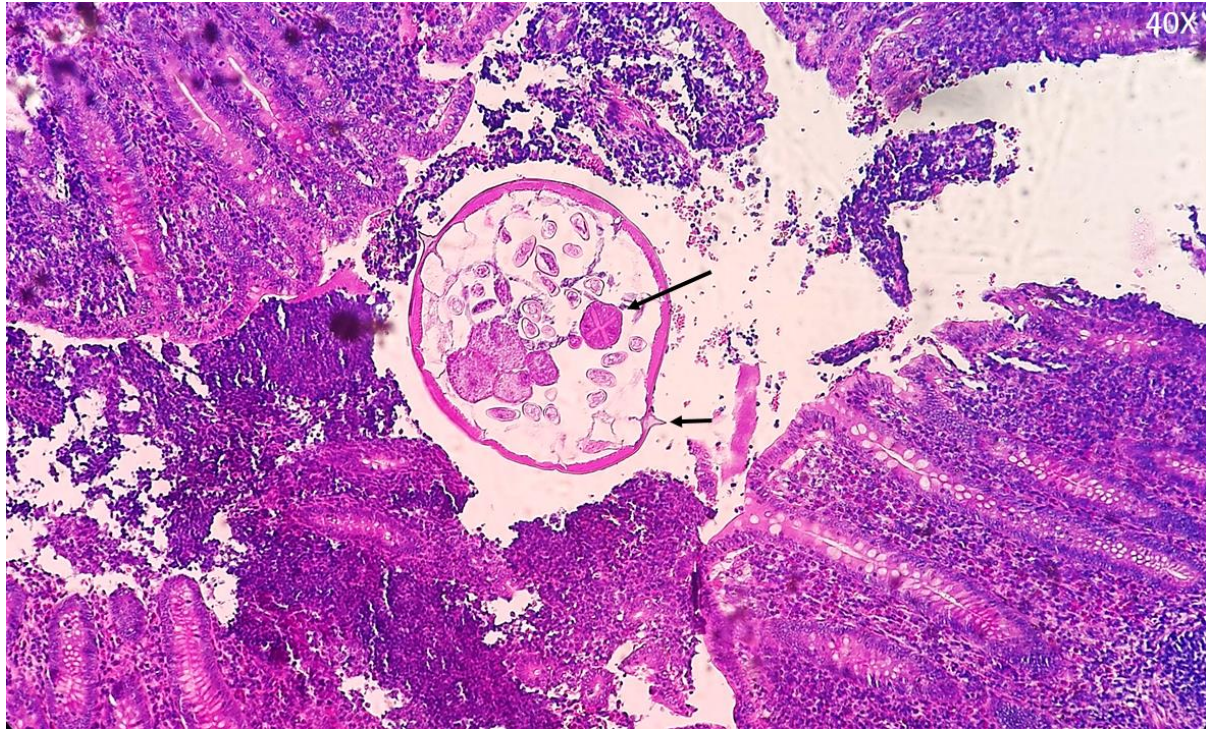
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**Figure 1.** The characteristics of adult *E. vermicularis* in cross section in the appendix, stained with hematoxylin/eosin staining (40×). Sectional view of female worm; large arrows indicate, muscular part of esophagus. Short arrow indicates cross section of expanded multi-layered cuticle and lateral cephalic alae. Distended uterus with intra-uterine eggs and sections of ovaries was seen.