

Enterobius Vermicularis Infection of the urinary bladder, kidney and urinary tract organs: Review and Update

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Received date: February 10, 2024; **Accepted date:** March 29, 2024; **Published date:** May 17, 2024

Citation: Grey Venyo AK, (2024), Enterobius Vermicularis Infection of the urinary bladder, kidney and urinary tract organs: Review and Update, *Clinical Research and Clinical Trials*, 10(1); DOI:10.31579/2693-4779/191

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Abstract:

Enterobius Vermicularis infection which is also called Pinworm infection or threadworm infection, and as well is referred to as enterobiasis, is a human parasitic disease that is caused by pinworm, Enterobius vermicularis. The most common manifesting symptom is itching or pruritus within the peri-anal region. The period of time from swallowing of the Pinworm eggs to the appearance of new eggs around the anus is stated to be between 4 weeks and 8 weeks. It has been pointed out that some individuals who are infected by Pinworm have tended to be asymptomatic. Enterobius Vermicularis is stated to spread between people by pinworm eggs. The pinworm eggs initially tend to be found around the anal region and they could survive for up to three weeks within the environment. Pinworms may be swallowed following contamination of the hands, food, or other articles. It had been pointed out that individuals who are at risk for the development of Pinworm infections are those who go to school, dwell within in a health care institution or prison, or who take care of individuals who are infected by pinworm. It has been iterated that another animal does not spread the Pinworm disease. It has been iterated that diagnosis of pinworm infection is established is by visualisation of the worms which are about one centimetre long or the eggs under a microscope. It has been iterated that treatment of pinworm infection is typically with utilisation of two doses of the medicaments including: mebendazole, pyrantel pamoate or albendazole two weeks apart. It has been recommended that every individual who dwells with or takes care of a pinworm infected person should be treated contemporaneously. Washing personal items in hot water pursuant to receiving each dose of medication has been recommended. Good hand-washing, daily bathing in the morning, and daily changing of underwear has been stated to help with regard to the prevention of pinworm reinfection. It has been iterated that pinworm infections commonly occur in all parts of the world and that pinworm infections are the most common type of worm infection within Western Europe, Northern Europe and within the United States of America. It has been documented that School-aged children are most commonly infected by Pinworms. It has been iterated that within the United States of America about 20% of children would develop pinworm at some point. It has also been documented that pinworm infection rates among high-risk groups might be as high as 50%. It has been pointed out that pinworm infection is not considered a serious disease and that pinworms are understood to have afflicted humans throughout history. The important thing to realise is that Pinworm infections could afflict the urinary bladder and organs of the urinary tract and unless clinicians have a high index of suspicion for pinworm infections of the urinary tract that had tended to be reported sporadically on rare occasions, the diagnosis could be delayed or missed. Pinworm infections of the urinary bladder and urinary tract could be asymptomatic or the manifestations tend to be non-specific including lower urinary tract voiding symptoms, abdominal discomfort or pain, loin discomfort or pain, non-visible haematuria, visible haematuria or spontaneous voiding out of worm-like material which the clinician confirms based upon visualisation of the worm or microscopy examination demonstrating features of the worm or finding of the worm in the process of cystoscopy or ureteroscopy examinations. Even though rare, clinicians need to be aware of the fact that Enterobius Vermicularis infection of the urinary bladder and urinary tract organs has tended to be reported on rare occasions.

Keywords: enterobius vermicularis infection of bladder; pinworm infection; enterobiasis; visualisation; microscopy; cystoscopy; visualisation; medication, recurrence; prevention; high index of suspicion; mebendazole; pyrantel pamoate; albendazole

Introduction

It has been iterated that one-third of individuals who are afflicted by pinworm infection have tended to be totally no-symptomatic [1] [2] The

main symptoms are itching (pruritus) in and around the anus as well as the perineum. [3] [4] [4] The itching occurs mainly during the night, [3] [5] and

is caused by the female pinworms migrating to lay eggs around the anus. [4] [6] Both the migrating females and the clumps of eggs are irritating, as well as the sticky substance that is produced by the worms when the eggs are laid. [5] [7] The intensity of the itching varies, and it can be described as tickling, crawling sensations, or even acute pain [8] The itching leads to continuously scratching the area around the anus, which can further result in tearing of the skin and complications such as secondary bacterial infections, including bacterial skin inflammation, and hair follicle inflammation [3] [4] [8] General symptoms are trouble in sleeping, and restlessness [3]. A considerable proportion of children do experience loss of appetite, weight loss, irritability, emotional instability, and bed wetting. [3] Pinworms cannot damage the skin, [4] and they do not normally migrate through tissue [4]. Nevertheless, might move onto the vulva and into the vagina, [3] [4] from there moving to the external orifice of the uterus, and onwards to the uterine cavity, fallopian tubes, the ovaries, and the peritoneal cavity. [4] This can cause inflammation of the vulva and vagina (vulvitis and vaginitis) [3] [4]. This causes vaginal discharge and itchiness of the vulva. [3] The pinworms can also enter the urethra, and presumably, they carry intestinal bacteria with them. [4] According to Gutierrez (2000), a statistically significant correlation between pinworm infection and urinary tract infections had been shown; [4] nevertheless, Burkhart & Burkhart (2005) had maintained that the incidence of pinworms as a cause of urinary tract infections remains unknown. [2] One report had indicated that 36% of young girls with a urinary tract infection also had pinworms, [2] painful micturition had been associated with pinworm infection. [2] The relationship between pinworm infestation and appendicitis had been researched, but there was a lack of clear consensus upon the matter: While Gutiérrez had maintained that there exists a consensus that pinworms do not produce the inflammatory reaction, [4] Cook (1994) stated that it is controversial whether pinworms are causatively related to acute [6], and Burkhart & Burkhart (2004) had iterated that pinworm infection causes symptoms of appendicitis to surface. [2] In view of the rarity of *Enterobius Vermicularis* infection of the urinary bladder and the urinary tract organs, the ensuing article related to *Enterobius Vermicularis* of the urinary bladder and organs of the urinary tract has been written and divided into two parts: (A) Overview that has discussed miscellaneous general overview aspects of *Enterobius Vermicularis* and (B) Miscellaneous Narrations and Discussions Related to *Enterobius Vermicularis* infections of the urinary bladder, kidney and urinary tract organs.

Aims

To review and update the literature on *Enterobius Vermicularis* of Urinary bladder, Kidney, and Urinary tract organs.

Methods

Internet data bases were searched including: Google; Google Scholar; Yahoo; and PUBMED. The search words that were used included: *Enterobius Vermicularis* of bladder; *Enterobius Vermicularis* of urinary tract organ; *Enterobius Vermicularis* of kidney; pinworm infection of bladder; and pinworm infection of urinary tract organs. Thirty-six (36) references were identified which were used to write the article which has been divided into two parts:

Results

[A] Overview [8]

Definition and General iterations [8]

- It has been documented that *Enterobius vermicularis*, which is also referred to as pinworm, is one of the most common nematode infections within the world. [8]

- It has been pointed out that originally, *E. vermicularis* was named *Oxyuris vermicularis*. [8]
- It has been iterated those human beings are the only natural host for this infection. [8]
- It has also been documented that transmission of *Enterobius Vermicularis* occurs in people who are dwelling within crowded environments and *Enterobius Vermicularis* usually occurs within families. [8]
- It has been documented that *Enterobius Vermicularis* worms are tiny, thread-like, and whitish and that the worm had been named after the characteristic pin-like tail that is found on the posterior part of female worms of *Enterobius Vermicularis*. [6] [8] [9]
- It has been pointed out that pinworm infestation usually afflicts children. [8]
- It has been documented that transmission of *Enterobius Vermicularis* is through direct contact with contaminated items or even during coital contact. [8]
- It has been iterated majority of *Enterobius Vermicularis* infections tend to be asymptomatic [8]
- It has also been pointed out that even though the cure rate of *Enterobius Vermicularis* has tended to be high, *Enterobius Vermicularis* recurrences are also common.[8]

Aetiology of *Enterobius Vermicularis* [8]

The aetiology of *Enterobius Vermicularis* had been summated as follows: [8]

- *Enterobius Vermicularis* infection most commonly afflicts children; nevertheless, any individual human being is susceptible to the development of *Enterobius Vermicularis* infection. [8]
- It has been pointed out that individuals from within tropical climates and school-aged children are the most vulnerable to *Enterobius Vermicularis* infection. [8]
- It has been pointed out that *Enterobius Vermicularis* infection is caused by the ingestion of the pinworm eggs and that the transmission of *Enterobius Vermicularis* infection is most commonly transmitted by the faecal-oral route.[8] [10]
- It has been documented that risk factors related to the development of pinworm infections include poor hygiene, eating after touching contaminated items and living with an individual who is identified as *Enterobius Vermicularis* egg positive. [8]

Epidemiology of *Enterobius Vermicularis* Infection

The epidemiology of *Enterobius Vermicularis* infection has been summated as follows: [8]

- The male to female infection frequency is 2 to 1; Nevertheless, a female predominance of infection has tended to be observed in individuals whose ages are 5 years and 14 years. [8]
- It has been iterated that *Enterobius Vermicularis* most commonly afflicts children who are younger than 18 years of age as well as that *Enterobius Vermicularis* is also commonly encountered in adults who take care of children as well as in institutionalized children. [8]
- It has been documented that the Centre for Disease Control and Prevention data had documented that there are about 40 million people who had been estimated to have been afflicted by *Enterobius Vermicularis* infection within the United States of America. [8]
- It has been iterated that transmission of *Enterobius Vermicularis* infection could occur through contact with contaminated clothes, bedding, personal care products, and furniture. [8]
- It has also been iterated that faecal-oral is the most common mode of transmission of *Enterobius Vermicularis* infection and that on rare occasions transmission of *Enterobius Vermicularis* infection could occur through inhalation mode when eggs are inhaled and then subsequently swallowed. [8]

Pathophysiology of Enterobius Vermicularis Infection

The pathophysiology of Enterobius Vermicularis infection has been summated as follows: [8]

- Enterobius vermicularis is an organism which primarily dwells within the ileum and caecum.
- Once Enterobius. vermicularis eggs are ingested, they tend to take about 1 month to 2 months to develop into adult worms which occurs within the small intestine. These do not usually cause any symptoms when they are confined to within the ileocecal area.
- The female adult Enterobius Vermicularis worms and ova migrate to the anal region mostly during night time and deposit thousands of eggs within the perianal region.
- This migration of Enterobius Vermicularis organism causes pruritus.
- Enterobius Vermicularis eggs hatch near the anal region where they cause peri-anal pruritus. This emanates into contamination of the fingers and results in ingestion of the eggs (autoinfection) and re-commencing of the life cycle of the worm. Occasionally, the larvae do migrate back into the rectum and to the small intestine and commence the life cycle (retro infection).

Clinical History and Examination Findings

The clinical history and examination findings in cases of Enterobius vermicularis infections had been summated as follows: [8]

- About one third of individuals who are afflicted by Enterobius vermicularis have tended to be asymptomatic.
- The most common manifesting symptom associated with pinworm infestation is perianal itching.
- Peri-anal erythema might be visualised due to the itching and scratching.
- At times a superficial bacterial infection could occur with the scratching sites emanating in erythema and warmth.
- Persistent itching could lead to disturbances in sleep and might lead to insomnia.
- Female Enterobius genitourinary infections had also been reported in the literature.
- Watery diarrhoea had also been documented in some patients who had been afflicted with Enterobius Vermicularis infection.
- It has been stated that at times abdominal pain and other serious complications like appendicitis could occur due to Enterobius Vermicularis worms blocking the lumen within the appendix or lead to inflammation around the appendix. [8] [11]
- It had also been stated that at times tiny thread-like worms might be visible to the naked eye within the peri-anal region.

Evaluation / Assessment of patients Afflicted by Enterobius Vermicularis Infection

The evaluation of Enterobius Vermicularis Afflicted Patients had been summated as follows: [8]

- Enterobius Vermicularis infection could be diagnosed via a cellophane tape test or pinworm paddle test where an adhesive tape-like material is applied to the perianal area and then examined under a microscope.
- The examination might demonstrate typifying ova that are 50 microns by 30 microns in size and have a flattened surface upon one side or might demonstrate the worms.
- Female worms are about 8 mm to 13 mm long while male worms tend to be 2 mm to
- 5 mm long.
- The examination is usually undertaken in the early morning for higher diagnostic yield.

- If the result of the examination is negative for five consecutive mornings, then the diagnosis is excluded.
- It has been pointed out that stool examination is not helpful in the diagnosis of Escherichia. vermicularis as they only tend to be occasionally excreted within the stool usually.
- It had also been stated that at times analysis of the stool specimen had been recommended to exclude other causes.

Treatment / Management of Enterobius Vermicularis Infection

The treatment / Management of Enterobius Vermicularis Infection had been summated as follows: [8]

- Treatment of Enterobius Vermicularis infection entails utilisation of following anti-helminthic medicaments:
 - ❖ Albendazole: is given upon an empty stomach, a 400-mg, one-time dose followed by a repeat dose in 2 weeks
 - Or
 - ❖ Mebendazole: A 100-mg, one-time dose followed by a repeat dose in two weeks
 - Or
 - ❖ Pyrantel Pamoate: This medicament is available over the counter in the United States of America; Dose of 11 mg/kg up to a maximum 1 gm given 2 weeks apart
- It had also been documented that other medicament that had been utilised to treat enterobiasis include ivermectin and piperazine, even though the latter has been documented to have lower efficacy and higher toxicity. [8] [12]
- Enterobiasis could cause recurrent reinfection, so treating the entire household, whether symptomatic or not has been recommended in order to prevent a recurrence of Enterobius Vermicularis infection. [8]
- It has been recommended that treatment of Enterobius Vermicularis infection in pregnancy should be reserved for patients who manifest with significant symptoms. It has also been iterated that in pregnant patients, pyrantel pamoate is preferred over other medications. [8]
- It has been iterated that young pinworm tend to be resistant to treatment and therefore two doses of medication, two weeks apart had been recommended. It had also been iterated that at the same time, all members of the Enterobius Vermicularis infected child should be treated as well as that if a large number of children are afflicted by Enterobius Vermicularis infection in a class, everyone should be treated twice at 2-week intervals as well as that patient follow up is vital in order to ensure that a cure had been achieved. [8]

Differential Diagnoses

The differential diagnoses of Enterobius Vermicularis Infection had been summated to include the following: [8]

- ❖ Pruritus ani
- ❖ Pruritus vulvae
- ❖ Atopic dermatitis

- ❖ Perirectal abscess
- ❖ Cellulitis

Prognosis of Enterobius Vermicularis infection

The prognosis of Enterobius Vermicularis Infection had been summated as follows: [8]

- The prognosis following a pinworm infection has tended to be excellent.
- It has been recommended that patients should undergo follow up assessments with their physicians after completion of their treatment to ensure they do not have any reinfection.
- It had also been iterated that if symptoms recur then testing and treatment as above should be re-commenced.
- Ectopic pinworm infections had been reported in many organs including the vagina, inguinal area, genitals, peritoneum, liver, oral cavity, lungs, and pelvis.
- There are even reported cases of appendicitis that is caused by impaction of the organ by pinworms.
- Whilst death ensuing Enterobius Vermicularis infection is very rare, Enterobius Vermicularis infection recurrences are common.
- Eradicating pinworms from institutions is very difficult and long-term surveillance is necessitated.
- In order to completely eradicate the pinworm infection, everyone within the classroom or in the family should be treated.

Complications associated with Enterobius Vermicularis Infection

The general complications associated with Enterobius Vermicularis infection had been summated as follows: [8]

- Occasionally a superficial bacterial infection could occur at the scratching sites in view of intense perianal pruritus.
- Other complications that had been documented are female genitourinary infections like vulvovaginitis, urinary tract infection in young girls.
- Appendicitis had also been documented as a complication of long-standing pinworm infestation.

Enterobius Vermicularis infections of the urinary bladder, the kidney and urinary tract.

Enterobius vermicularis infections of the urinary bladder and urinary tract are extremely rare and the symptoms have tended to be non-specific and unless a high index of suspicion is not exercised, the diagnosis may be delayed or missed or the diagnosis may emanate as a surprise to the clinician. In view of the rarity of Enterobius Vermicularis infection of the urinary bladder and urinary tract, urinary

tract affliction of Enterobius Vermicularis has been separately documented in the next section of the article. [8]

[B] Miscellaneous Narrations and Discussions from some Case Reports, Case Series, and Studies Related to Enterobius Vermicularis Infections of the Urinary Bladder, Kidney and organs of the Urinary Tract.

Choudhury et al. [13] stated the ensuing:

- It has been iterated that Enterobius infestation is endemic within tropical countries with the prevalence of up to 46% in some areas. [14]
- Most common site of infestation of Enterobius Vermicularis is the gastrointestinal tract.
- Uncommon sites for infestation of Enterobius vermicularis include: the vulva, vagina, uterus, fallopian tubes, ovary, and even peritoneum through fallopian tube in females.
- Other rare reported site of Enterobius Vermicularis infection include: the lung, liver, breast, and spleen. [15]
- Transmigration of intestinal flora to urinary tract with Enterobius had been documented as one of the reasons for recurrent urinary tract infection (UTI) in areas with high prevalence of enterobiasis. [16]

Choudhury et al. [13] reported a 58-year-old lady, who had presented to their outdoor clinic with a history of recurrent dysuria and increased frequency of micturition over the preceding 9 months. She did not have any history of associated fever or haematuria. Nevertheless, the patient complained of having occasional pruritus within her peri-anal and peri-urethral region. The patient was known to be diabetic and she was on oral hypoglycemic medicaments. She denied having any history of urethral instrumentation in the past. She had previously been treated with prophylactic antibiotics, but her symptoms had not resolved. The results of her repeated urine culture came out to be sterile; nevertheless, she had increased pus cells within her urine. One week before her outdoor visit, the patient had noticed small, white worms within her urine. She carried one such urine sample to the outdoor clinic (see figure 1). Upon low power microscopy examination, the worm was identified as Enterobius vermicularis. She had ultrasound scan screening of her kidney, ureter, and urinary bladder region, which demonstrated some echogenic floating materials within her urinary bladder. She underwent cystoscopy examination, which failed to demonstrate any worm-like structure within her urinary bladder or any other abnormality. Planoconvex ova of the Enterobius Vermicularis were identified within her urine sample; nevertheless, wet mount examination of her stool specimen did not demonstrate any eggs. The patient was treated by a single dose of 400 mg of oral albendazole which was repeated after 2 weeks in order to eradicate any emerging parasites. The symptoms of the patient completely resolved and there was no recurrence of her symptoms at her 6-month follow-up. Her urine upon examination during her 6 months follow-up assessment did not reveal any abnormality.



Figure 1.

Adult pinworm isolated from urine. Reproduced from [13] under the Creative Commons Attribution License.

Choudhury et al. [13] made the ensuing educative summing discussions:

- Enterobius Vermicularis is one of the most common parasites inhabiting human gastrointestinal tract.
 - Enterobius Vermicularis is ubiquitous in geographical distribution and affects both genders equally.
 - The majority of infections tend to be attributed to shared infective source and low socioeconomic status.
 - The gravid female is a nocturnal migrator, which either dies during the excursion or returns safely to the anal canal.
 - Most frequent manifesting symptom of enterobiasis is itching within the peri-anal region; nevertheless, the majority of pinworm infections had tended to be asymptomatic.
 - An abnormal route is taken at times, which involves the vagina in females, through which the Enterobius Vermicularis can ascend into the uterus to fallopian tube to ovary or drop into the peritoneum.
 - Migration of Enterobius Vermicularis within the urethra is rare and only a few cases had been reported in literature by the time of publication of their article. [17] [18]
 - Urinary tract infestation by Enterobius Vermicularis generally occurs by ectopic movement of pinworms which might also carry Escherichia coli and other bacteria from the rectum into the urinary tract. [19]
- In children, Enterobius Vermicularis infection was also found to be related to introital bacteriology and development of recurrent urinary tract infections (UTIs) [20]
 - As the life span of pinworm is only for few months, such an infection usually has tended to resolve spontaneously.
 - Diagnosis of Enterobius infestation is established by either scotch-tape test or finding of worms or typical planoconvex ova within the stool or rarely within urine sample.
 - It has been iterated that routine examination of stool sample establishes positive diagnosis in only 5% to 15% of patients. [2]
 - It had also been documented that the best time to identify Enterobius Vermicularis ova is in the morning, so scotch-tape test should be undertaken in the morning.
 - It had been pointed out that a single examination detects 50% infection whereas three consecutive tests does tend to detect 90% of infestation. [21]
 - Effective medical treatment is available. Nevertheless, in view of its frequent recurrence and shorter life span, a community-based approach is preferred by regular inspection and improvement in personal hygiene in high-prevalent areas.
 - Treatment of enterobiasis is undertaken utilising mebendazole, albendazole, or pyrantel pamoate, usually single dose followed by repetition after 2 weeks to eradicate emerging parasite.
 - Enterobius Vermicularis is a well-adapted parasite of human beings with ubiquitous distribution.

- Ectopic migration and involvement of urinary tract by *Enterobius Vermicularis* might lead to the development recurrent urinary tract infections (UTIs).
- Recurrent UTI is a rare manifestation of *Enterobius Vermicularis*, and its diagnosis is challenging in terms of the rarity of the disease and thus low clinical suspicion. Zahariou et al. [17] made the ensuing iterations and summations:
- *Enterobius vermicularis* is an intestinal nematode which afflicts of human beings.
- Adults usually have low worm burdens and they tend to be asymptomatic.
- Ectopic infections of *Enterobius Vermicularis* within the pelvic area or urinary tract rarely occur in women.
- They had reported a case of a patient who had mild voiding difficulties such as urinary urgency, urinary frequency, nocturia, dysuria, mild low back pain or perineal discomfort. The patient's prostatic secretions had shown a large number of inflammatory cells and several eggs. The size and the shape of the eggs had identified them as a group of *Enterobius Vermicularis*. Upon examination they had found a soft palpable material which was 5 mm diameter in size and spherical shape. Palpation gave the impression of a tissue than a stone. An incision was undertaken and a 4 mm long living worm was found. The microscopy examination had identified the worm as *Enterobius vermicularis*. It is an extremely rare manifestation of *Enterobius vermicularis* infection since an intestinal-breeding worm is rarely found in the male genital tract.
- *Enterobius vermicularis* is an intestinal nematode of human beings and its principal mode of transmission is by direct contact between infected and uninfected persons.
- Human infections of *Enterobius Vermicularis* occur when the eggs in the infective stage are accidentally ingested in a contaminated environment.
- Even though the majority of infections have tended to be asymptomatic, it induces bothersome symptoms in some cases. This condition is referred to as "enterobiasis" and it includes perianal itching and dermatitis [22].
- Adults usually tend to have low worm burdens and tend to be asymptomatic. Nevertheless, in children, particularly when there are heavy worm burdens, neurological symptoms such as nervousness, restlessness, irritability and distraction might occur, and these might have influence on child growth [22].
- It has been stated that on rare occasions ectopic infections in the pelvic area or urinary tract occur [16] [23]
- They had reported a case of a male adult patient with a prostatitis and a chronic pelvic pain syndrome due to *Enterobius vermicularis* which was successfully treated with antihelminthic regimens. Zahariou et al. [17] reported a 65-year-old man, who had presented to the Outpatient Department of Elpis Hospital, for evaluation of a chronic bacterial prostatitis. He had manifested mild irritative voiding difficulties such as urinary urgency, urinary frequency, nocturia, dysuria, a mild low back pain and perineal discomfort. Even though he did not have any urethral discharge, the patient complained of local burning sensation upon micturition as well as an itching sensation within his urethra. His symptoms had lasted for fifteen days. A complete review of his systems was reported to be unremarkable as well as his medical and family history. The patient's hemogram was reported to be normal without leucocytosis. His midstream urine demonstrated non-visible haematuria, pyuria but no bacteriuria which identified the organism infecting the urinary tract was found. His serum prostate specific antigen (PSA) values were elevated at 7.6 ng/ml with a free PSA/total PSA ratio 39%. He had trans-rectal ultrasound scan which demonstrated a cystic mass within the transitional zone of his prostate gland with a solid and a nodular inner portion. Upon rectal examination, the prostate gland was noted to be normal in size and consistency. The prostatic secretions that were obtained by prostatic massage had shown a number of inflammatory cells (more than 30 white cells per high-power field) but no causative infectious agent was found by culture or other means. Several eggs were observed amongst the inflammatory cells which measured 51–59×26–29 μm with one convex side (see figure 2). The size and shape of the eggs were adjudged to have depicted features which had identified them as a group of *Enterobius vermicularis*. On examination of the prostatic secretions, a soft palpable material was found which was 5 mm diameter in size and spherical shape. Palpation gave the impression of a tissue rather than a stone. An incision was undertaken in this material and a 4 mm long living worm was found. (see figure 3). Microscopy examination identified the worm as *Enterobius vermicularis*.

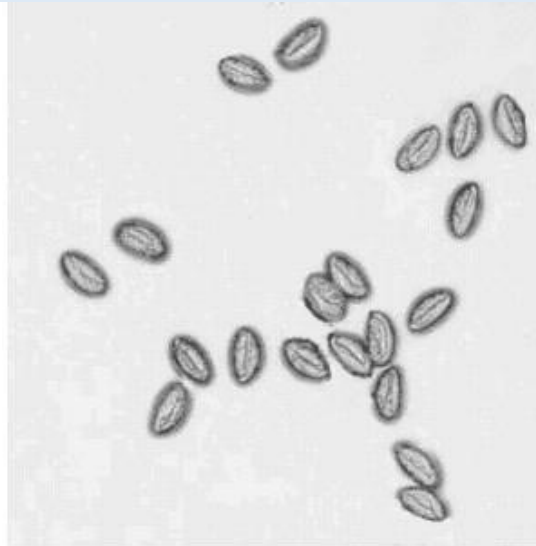


Figure 2.

E Vermicularis eggs (wet mount). Reproduced from: [17] under the Creative Commons Attribution License.



Figure 3.

The living worm (left) after the incision of its spherical envelope (right). Reproduced from [17] under the Creative Commons Attribution License.

Even though there was a speculation that the infection was sexually transmitted, the patient denied it. The patient did not experience any symptoms from the gastrointestinal tract or itching sensation within his anus. The cello-tape test was undertaken and a microscopy examination identified *Enterobius vermicularis* eggs. Even though the patient had a negative cello-tape test and no irritative symptoms he was treated with mebendazole 100 mg PO bid for 3 days followed by two more courses with 3-week time interval. At his six-month follow-up assessment, there had been no recurrence of enteroparasitosis. After informing the patient, his three grandsons were examined using the cello-tape anal swab technique (one smear per child), for the presence of *Enterobius vermicularis* eggs. All three samples were positive for parasite eggs and the children were treated with the same antihelminthic regimen.

Zahariou et al. [17] made the ensuing discussions:

- *Enterobius vermicularis* is one of the most frequently encountered and ubiquitous nematodes.
- *Enterobius Vermicularis* is highly contagious and parasitizing the human intestinal tract.
- Majority of human infections had been reported to occur in preschool children and grade school children, particularly those who engage in group activity.
- It had been known that the transmission of enteroparasites depends upon the presence of infected individuals, sanitation deficiencies and, principally, the socioeconomic and cultural conditions of the population.
- Among adults, *Enterobius vermicularis* infection has tended to be similar in both sexes, but it was commonly observed that many adults seemed not to get infected even when they are subjected to contaminated environments due to personal hygiene [24].

- Based upon their reported case, the urethra seemed to be the only route that the threadworm could have traversed to reach the urinary tract.
- Ordinarily, after a nocturnal egg laying excursion, the gravid female worms either die or return through the anus to their proper intestinal habitat.
- Occasionally, they lose their way and enter the vagina.
- They might then ascend to the genital tract, and even reach the peritoneal cavity along the lumen of the uterine tubes.
- Ovarian enterobiasis is rare but several cases had been recorded in the literature [18].
- The uterine tubes and peritoneal serosa are the most common sites of ectopic enterobiasis.
- The majority of these patients had reported symptom of abdominal pain.
- On rare occasions, more serious disease could result, including weight loss, urinary tract infection and appendicitis [25]
- Other orifices, whether it is natural or as result of a disease, might also mislead them.
- Surprisingly, there seems to be no indisputable record of threadworms entering the urethra, in spite of its accessibility.
- There are, nevertheless, a few published observations which had supported the possibility that sometimes they may take this path, and these had been cited elsewhere. [26] [27]
- Mainly, no good evidence had ever been produced that threadworm could penetrate through a healthy epithelial surface [28] [29].
- Effective antihelminthic regimens had been developed and utilised for decades. Nevertheless, the control of enterobiasis is difficult in view of frequent recurrences and a short life cycle. Therefore, continuous health education concerning improvement of personal hygiene and regular inspections are necessary in order to control enterobiasis.

Zahariou et al. [17] made the ensuing conclusions:

- Repeated health education concerning improvement personal hygiene and regular inspections are necessary to control enterobiasis.
- Worm infection should be rarely suspected in patients who genitourinary symptoms or pelvic pain, in which a complete laboratory evaluation fails to establish the diagnosis.

Sammour et al. [30] stated the following:

- *Enterobius vermicularis* (pinworm) is one of the most prevalent intestinal parasites in the world.
- The urinary tract is rarely affected and few cases had been reported.
- They had reported a case of urinary bladder infestation by mature female worms of *Enterobius Vermicularis* in a woman who had manifested with irritative voiding symptoms.

Sammour et al. [30] reported a 54-year-old woman, who had manifested with a history of irritative urinary voiding symptoms for one month. She had recently been treated with norfloxacin, with no

improvement. Her urinalysis demonstrated leucocyturia, and her urine culture was negative. She had Computed Tomography (CT) scan of her abdomen which showed an 8 mm stone within her distal left ureter, which was removed endoscopically. Her cystoscopy was normal during her ureteroscopy stone removal. Her voiding symptoms did not improve after her ureterolithotripsy, and she had persistent leucocyturia despite negative urine cultures and three courses of antibiotics. She had a second CT scan which did not demonstrate any urological abnormalities. She was treated with analgesics; after two months the patient noticed two worms within her own urine and brought them to the clinic. The worms were examined in a parasitology laboratory and a diagnosis of mature female *Oxyurus* worms (*Enterobius vermicularis*) was made. The patient was treated with 200 mg mebendazole once a day, for three days, with complete resolution of her urinary voiding symptoms and normalization of her urinalysis. A scotch-tape test applied to the perianal and perineal areas after treatment was negative. In her follow-up after six months, the patient remained asymptomatic.

Sammour et al. [30] made the ensuing discussions:

- It had been iterated that Enterobiasis (oxyuriasis or pinworm infection) is the most common helminth infection in the USA and Western Europe, particularly amongst school-aged children. [2]
- Human beings are the only host for the *Enterobius Vermicularis*, which is acquired by the ingestion of infective eggs by direct anus-to-mouth transfer.
- Adult worms of *Enterobius Vermicularis* are usually found within the caecum and the adjacent regions of the large and small intestines.
- Downward migration to the peri-anal and perineal region is the common path for gravid females in their attempt to expel eggs [2].
- Occasional invasion of unusual sites had been reported, most commonly the female genital tract [31] [32]
- The finding of eggs within urine of children had been reported in the literature; it generally occurs by autoinoculation [16] [33] [34].
- To their knowledge, only two cases of infestation of the urinary tract by adult *E. vermicularis* had been reported up to the time of the report of their case [35] [36].
- Diagnosis of intestinal pinworm infection is commonly established by a scotch-tape test applied to the perineal and perianal areas of the patient during the night, based on the finding of eggs of this parasite.
- Faecal examinations are generally negative [2].
- Mebendazole (100 mg orally in a single dose, repeated in one week) has tended to be the standard treatment for most pinworm infections. Nevertheless, less than 2% of the drug is absorbed and an additional agent might be needed for the treatment of urinary infections.
- Ivermectin (200 µg/kg body weight, single dose) might be a good choice, given its pharmacological distribution within the urinary tract [2]. Sammour et al. [30] concluded that pinworm infection could be a differential diagnosis in patients who manifest with lower urinary tract symptoms and negative urine cultures, even though it requires a high index of suspicion.

Conclusions

- Enterobius Vermicularis infection can be encountered throughout the world and the infection is endemic within tropical countries with the prevalence of up to 46% in some areas.
- Most common site of pinworm infection is the gastrointestinal tract.
- Uncommon sites for infestation of Enterobius Vermicularis include: the vulva, vagina, uterus, fallopian tubes, ovary, and even peritoneum through fallopian tube in females.
- Other rare reported sites of Enterobius Vermicularis infection include: the lung, liver, breast, and spleen.
- Transmigration of intestinal flora of Enterobius Vermicularis to the urinary tract had been documented to be one of the reasons for the development of recurrent urinary tract infection (UTI) in areas with high prevalence of enterobiasis.
- Enterobius Vermicularis is a well-adapted parasite of human beings which is associated with ubiquitous distribution.
- Ectopic migration and involvement of the urinary tract might lead to the development of recurrent UTI or urinary bladder involvement.
- Recurrent UTI, or involvement of the urinary bladder, upper urinary tract and the kidney is a rare manifestation of Enterobius Vermicularis, and its diagnosis has tended to be challenging in terms of the rarity of the disease and low clinical suspicion of the infection by clinicians.

Conflict Of Interest – Nil

Acknowledgements

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DOI:10.31579/2693-4779/191

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