The Case of *Enterobius vermicularis* as a Cause for Acute Appendicitis

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Abstract

**Background:** *Enterobius vermicularis* infection, previously known as *Oxyuris vermicularis*, is the most common type of infection from a parasite in Western Europe and the United States. Most individuals with *E. vermicularis* do not have any symptoms. It is considered a rare pathogen and an atypical cause for appendicitis. Laparoscopic appendectomy is the most frequent on-call surgery done as an emergency. We tried to evaluate the effect of this rare cause of appendicitis on outcomes after appendectomy for acute appendicitis in adults.

**Methods:** After obtaining approval of our institutional review board, the medical records of patients who underwent a laparoscopic appendectomy or a diagnostic laparoscopy for suspected acute appendicitis between 2000 and 2012 in Surgery A at Soroka University Medical Centre, Beer-Sheva, Israel, were reviewed retrospectively. A total of 610 eligible subjects were admitted with suspected appendicitis either due to a regular cause (the control group) or appendicitis due to *E. vermicularis* (the parasite group). The patients were operated on by novice surgeons, chief residents, and senior surgeons. Preoperative variables were compared, as well as surgical outcomes and complications.

**Results:** Of the more than 800 patients enrolled, a sample of 93 control patients and three patients in the parasite group were included in the study. In univariate analysis we found no connection between suffering from appendicitis due to *E. vermicularis* and “regular” causes of appendicitis, as seen in demographics and intra- and post-op complications.

**Conclusions:** Although conclusions are based on small sample size, in our retrospective study parasitic cause of acute appendicitis in adults does not appear to adversely affect 30-day outcomes.

**Keywords:** Acute appendicitis; *Enterobius vermicularis*; Etiology

Introduction

Acute appendicitis is an inflammation of the appendix, which has many attributable etiologies [1,2]. One rare cause is inflammation or direct luminal obstruction due to parasite infestation. There have been case reports about parasites as a pathological finding after removal of the appendix in patients suffering from acute appendicitis [3–5]. Some studies speculate on the parasitic causing symptoms mimicking acute appendicitis while others attribute the infestation as another cause of obstruction leading to inflammation of the appendix [6]. Pathogens such as *Enterobius*, *Taenia*, *Schistosoma*, *Ascaris lumbricoides*, and *Oxyuris equi* have been attributed as causes for acute inflammation of the appendix [4,5]. Large retrospective studies aimed at finding the incidence of parasitosis in appendicitis have found correlations anywhere from 0.2% to 41.8% [3,5,7]. However, this is only a correlation, and thus it is difficult to determine a causal relationship. *Enterobius vermicularis* (or *Oxyuris*, which is another name of this pathogen) infection is the most common type of infection from a parasite in Western Europe and the United States [8,9]. It is mainly seen in children of school age, but can also be found in adults. *Enterobius vermicularis* is a worm-like parasite. Complications are much more common in women than in men. This stems from the fact that the female worm, after depositing her eggs, loses her way while trying to return to the colon, entering the vagina instead, travelling up the uterus and fallopian tubes. In the majority of cases, the only symptoms associated with *Enterobius vermicularis* are slight itching around the rectum. Most individuals infected with *E. vermicularis* do not have any symptoms [6–8]. *Enterobius* is considered a rare pathogen and an atypical cause for appendicitis [4,10,11]. As of now, only isolated case reports with a wide distribution of locations have shown acute appendicitis with *E. vermicularis* as cause on pathology, as can see in the pathology slides attached to this manuscript (Figures 1–3).

**Methods**

The aim of the study was to examine the difference and clinical implications of patients suffering from acute appendicitis due to parasite infestation (i.e., *Enterobius vermicularis*) in comparison to patients who suffered from the regular causes for appendicitis (the control group). Patients with suspected acute appendicitis who underwent a laparoscopic appendectomy or a diagnostic laparoscopy were enrolled as this control group and the study group was patients who suffered from acute appendicitis due to parasite infestation. We tried to have a representative sample of our lap appendectomy patients due to regular causes as our control group. We measured thirty-day overall morbidity and serious morbidity/mortality events. After obtaining approval from our institutional review board, a retrospective cohort study was conducted using the medical records of all patients undergoing lap appendectomy between 2000 and 2012 in Surgery A at Soroka University Medical Center, Beer-Sheva, Israel.

**Figure 1:** A photograph of the lumen of the appendix under regular microscopy.
Patients who have undergone incidental or elective appendectomy were excluded from the study. The retrieved data includes patient’s demographics, preoperative laboratory and imaging data, intra-operative findings and pathology results, surgery time, intra- and post-operative complications, surgery outcome, and length of postoperative hospital stay.

A standard laparoscopic appendectomy via three ports was carried out. A diagnosis of acute appendicitis (AA) was based solely on the pathological findings of the appendix.

Postoperative complications were determined as infectious when post-operative fever, intra-abdominal abscess or phlegmon, wound infection, or urinary tract infections or pneumonia were present after surgery.

### Statistical Analysis and Sample Size Calculation

The data were coded and stored using a Microsoft Office Excel program, and analyzed with SPSS 18.0 (SPSS, Chicago, IL). Data are reported as mean ± SD. The comparison of groups was conducted using Pearson Chi square for categorical variables and Fisher's exact tests for dichotomous variables when applicable. Thus, when comparing the males/females proportion in the control and the cases group we have used Fisher's test due to expected count smaller than five. Comparison of quantitative variables was done using parametric (t-test) and a-parametric tests (Mann-Whitney test). Thus, when comparing the ASA score in the control and cases group, we used the Mann-Whitney procedure. The same applies for categorical variables which were analyzed using the Fisher exact test. Differences were considered statistically significant at $p < 0.05$.

### Results

In the current study, we have had 96 patients enrolled, all of whom were operated under the assumption of suffering from acute appendicitis and undergone lap appendectomy. Of them 60 (62.5%) were females. Seventy-four patients (88.1%) were admitted under the assumed diagnosis of acute appendicitis, 6 (7.1%) with the diagnosis of abdominal pain and 4 (4.8%) with peritonitis.

The average duration of illness before admission was 36.9 hours ($\pm 31.8$), and the average leukocyte count was $13.1/ 4.7$. The average age on diagnosis was $40.33/ 16.7$, 32 patients (41.6%) had any background illnesses. The median ASA was 1. The mean duration of the operation was 42.44 minutes (±19.8). The average hospital stay was 3.1 days (±4.13), with an average post-op hospital days of 3 (±4.13). Six patients (6.3%) had surgical complications, and 3 (3.1%) needed another operation. Three patients (3.1%) were re-admitted in the month following the operation.

Of the 96 patients, under pathology exam three had an Enterobius infection; the other patients served as a control. In the control group 58 patients were females (62.4%), whereas in the parasite group 2 (66.7%) were females (Fisher exact test; NS). In the control group 72 patients had a pre-op diagnosis of acute appendicitis (77.4%), whereas in the parasite 2 (66.7%) were operated under the assumption of acute appendicitis (Fisher exact test; NS). In the control group 68 patients (73.1%) had no imaging prior to the operation, whereas in the parasite group 2 (66.7%) had no imaging.

In the control group 44 (58.7%) had no prior medical background, whereas in the parasite group 1 had prior medical background (50%, due to missing values, Fisher exact test; NS). Three patients in the control group (3.2%) needed another operation, and none in the parasite group. Six patients in the control group (6.5%) needed another operation, and none in the parasite group. Three patients in the control group (3.2%) were re-admitted within 30 days, and none in the parasite group.

The median ASA score for the control group was 1, whereas in the parasite group it was 1.5 (MW = 58; $p = 0.867$). The average age in the control group was 40.22 (±16.6), in comparison to 43.7 (±21.7) in the parasite group (MW = 130; $p = 0.841$). The average duration of illness before admission in the control group was 37.7 hours (±32), whereas in the parasite group it was 12 hours (MW = 16; $p = 0.059$). The average leukocyte count upon admission was 13.23 (±4.7) for the control group, in comparison to 9.7 (±1.07) in the parasite group (MW = 59; $p = 0.093$).

"Figure 2: A photograph of the lumen of the appendix under a larger magnification, see the marked lesions which are the worms."

"Figure 3: Transverse section of the adult worm in the lumen of the appendix that was seen in Figure 2."
The average hospital stay in the control group was 3.65 days (± 4.2) in comparison to 2.3 days (± 1.5) in the parasite group (MW = 112.5; p = 0.562). The mean post-op hospital stay was 3.1 days (± 4.2) in the control group, in comparison to 1.7 (± 2.1) in the parasite group (MW = 93; p = 0.294). Operation duration was 42.5 minutes (± 20) in the control group, in comparison to 41.7 minutes (± 12.6) in the parasite group (MW = 127.5; p = 0.846).

**Discussion**

When thinking of acute appendicitis, considering parasites as the cause for this illness seems a bit far-fetched. But, Enterobius infestation as a cause for appendicitis has been documented [4,10,11], and the question that arises is whether these patients fare worse than “regular” appendicitis patients. When looking at the pre-op variables of the patients who suffered from Enterobius infection and the control group (e.g., gender, pre-op diagnosis of appendicitis, prior medical background, age, ASA, average duration of illness before admission, average leukocyte count), no statistical difference was found. When considering operation and post-op variables, such as average hospital stay, no difference was found. When looking at the need for another operation and re-admittance, it seems that the Enterobius patients fared better. Thus, we can say that there is no connection between suffering from appendicitis due to E. vermicularis and “regular” causes of appendicitis.

Even though Enterobius is considered a rare pathogen and an atypical cause for appendicitis, large retrospective studies aimed at finding the incidence of parasitosis in appendicitis have found correlations to be anywhere from 0.2% to 41.8% [6,7,9,11]. Thus, one can expect that during one’s career as a general surgeon he/she might find themselves treating appendicitis caused by Enterobius and one might ponder whether this means a grave outcome. Our study has shown no added morbidity or mortality in patients with appendicitis caused by Enterobius and thus one can conclude that routine treatment during hospitalization should be similar until pathology results show that it is due to Enterobius.

But, another question is about treatment after the parasite has been identified during pathology. One must remember that E. vermicularis has the broadest geographic range of any helminth and is the most common intestinal parasite seen in the primary care setting. Underappreciated is the fact that it is not always a benign infection, urinary tract infections, epididymitis, salivary glanditis, and abdominal and perianal infection. Both the patient and the family members should be treated, as E. vermicularis is easily spread throughout households. Thus in case of Enterobius infestation (as seen with our patients with appendiceal infestation), systemic therapy of patient and family is necessary [4]. Anthelmintics, such as mebendazole, pyrantel, and levamisole, are active against E. vermicularis. Reinfection with E. vermicularis immediately after the completion of drug therapy is common. Additionally, young pinworms may be resistant to drugs [10].

Successful eradication of pinworm infection requires at least three doses of medication, separated by three weeks [11]. All family members or classmates who are infected must be treated simultaneously. In addition, personal and group hygiene must be improved, individuals must wash their hands before eating, and children should be discouraged from activities such as finger-sucking [10]. Thus, even though the post-op outcomes seem to be the same, a lot of attention and patient education should be done in order to prevent future complications and morbidity to the patients infested with Enterobius vermicularis.

**Conclusion**

As mentioned, Enterobius most commonly affects the anus, but may also affect almost any other part of the gastro-intestinal tract. Research has shown that appendicitis due to Enterobius is rare, but is a logical cause for this illness due to congestion of the lumen. The current study is unique in that this is the first study that has shown that there is no difference in morbidity or mortality in patients who suffer from acute appendicitis caused due to parasites and to less bizarre causes. Thus, it seems logical to conclude that the treatment for appendicitis due to parasitic infestation is appendectomy. But, one must remember that the appendectomy by itself is not a cure for the parasites in the other parts of the GI tract, and thus after getting pathology results of such patients, one must inform their primary care physician and advise the patient to get the proper anti-parasitic treatment (Mebendazole).

Allowing for the limitations of our study due to sample size, we can conclude that laparoscopic appendectomy for patients who had acute appendicitis due to parasitic infection discovered in pathology is as effective as laparoscopic appendectomy due to regular causes.

**Conflict of Interest**

The authors declared no conflict of interest.

**References**


