

# Incidental Parasitic Infestations in Surgically Removed Appendices and its Association with Inflammation

Muhammad Arham <sup>1</sup>, Muhammad Arish <sup>1</sup>, Jahangir Sarwar Khan <sup>2</sup>

1. Medical Student, Rawalpindi Medical University; 2. Department of Surgery, Holy Family Hospital and Rawalpindi Medical University, Rawalpindi

## Abstract

**Background:** To determine the frequency and type of parasitic infestations in surgically removed appendices based on histopathological findings and to assess its association with inflammation.

**Methods:** In this cross-sectional study 471 appendices removed were included and their histopathologic examination reports were observed. In cases with parasitic infestations, information regarding gender, age and presence of inflammation was gathered. Fisher's exact test at 5% level of significance was applied to compare presence of inflammatory infiltrates in appendices with and without parasites.

**Results:** Of the 471 appendectomies performed, 15 (3.18%) specimens were found to contain parasites, all of which were *Enterobius vermicularis* (pinworm). In those 15 cases, age of patients ranged from 9 to 45 years with a mean age of  $19.07 \pm 9.04$  years. Out of those 15 patients, 11 (73.3%) were females and 4 (26.7%) were males (male to female ratio was 1:2.75). Only 2 out of 15 cases (13.3%) with parasitic infestation had inflammation, whereas in 456 of the remaining non-parasitic appendices, 324 (71.1%) were positive for inflammation. This difference was statistically significant with a p value < 0.05.

**Conclusion:** Frequency of parasitic infestations in surgically removed appendices is low. Very few appendices with parasitic infestation are associated with inflammation as compared to appendices without parasites.

**Key Words:** Parasitic Infestations, Appendices, *Enterobius vermicularis*

## Introduction

Parasitic infestation of the appendix can cause appendiceal colic similar to the right lower quadrant pain of usual acute appendicitis. The vermiform appendix, mostly considered to be a vestigial organ, is a blind ending pouch extending from the posteromedial wall of the cecum.<sup>1</sup> Appendicitis is

defined as the inflammation of the mucosa of the vermiform appendix.<sup>2</sup> Acute appendicitis is the most common cause of an 'acute abdomen' and one of the most common reasons for emergency gastrointestinal surgery.<sup>3-6</sup> It is generally seen in patients aged 10-30 years and is the most common cause of emergency abdominal surgery in children.<sup>7</sup> The lifetime risk of acute appendicitis for men and women is 8.6% and 6.7%, respectively.<sup>8</sup> The inflammation usually results from obstruction of the appendiceal lumen which can be attributed to lymphoid hyperplasia within the appendix or mechanical obstruction by a fecolith or a stricture.<sup>6</sup> Due to this obstruction, the mucus secreted by the appendiceal glands and the inflammatory exudate continues to accumulate within the lumen. The intraluminal pressure gradually increases and becomes sufficient to obstruct the lymphatic drainage and later on the venous blood flow, leading to ischemia of the appendix wall. This is followed by bacterial invasion through the muscularis propria and submucosa, producing acute appendicitis.<sup>2</sup>

Interestingly, the initial insult of appendiceal obstruction can be caused by parasites in its lumen and lead to the right lower quadrant pain of usual acute appendicitis, which may or may not be associated with inflammation.<sup>9-12</sup> Physical signs and symptoms of such patients are similar to the cases of classic acute appendicitis. However, in the absence of any inflammatory reaction, such an infestation is considered to be a component of false acute appendicitis.<sup>10</sup> *Enterobius vermicularis*, *Schistosoma* species, *Taenia* species and *Ascaris lumbricoides* are most commonly associated with appendicitis.<sup>7,13</sup> However, it is still not clear that whether the parasites found in the appendix are actually involved in the pathogenesis of appendicitis or are just an incidental finding.<sup>14,15</sup>

## Patients and Methods

This cross-sectional study was conducted in Pathology department of Benazir Bhutto Hospital, Rawalpindi. All 471 appendices that were removed either by

laparoscopic or open appendectomy were included in the study. In cases with parasitic infestations, further information regarding gender and age of patients was gathered. Presence or absence of inflammatory reaction in those appendices with parasites was noted. Similarly, the number of appendices with inflammation but without parasites was also determined. Fisher's exact test at 5% level of significance was then applied to compare the presence of inflammatory infiltrates in appendices with and without parasites.

## Results

A total of 471 appendectomies (laparoscopic and open) were performed at Benazir Bhutto Hospital, Rawalpindi in 2016. Of the 471 appendectomies performed, 15 (3.18%) specimens were found to contain parasites.

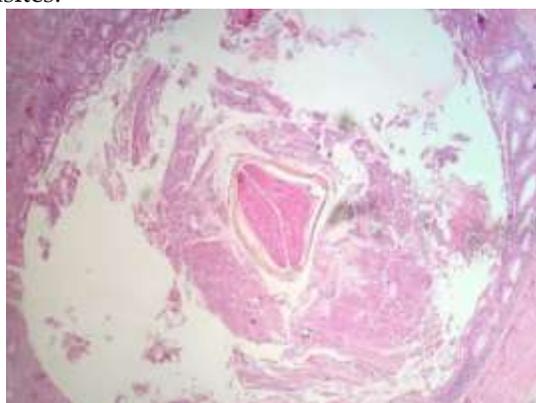


Figure 1: Pinworm infestation within the lumen of appendix without acute inflammation

Table 1: Pattern of inflammation in appendices with and without pinworms

	Appendices with Pinworms	Appendices without pinworms
Inflammation present	2	324
Inflammation absent	13	132

The parasite in all those 15 cases was *Enterobius vermicularis*, also known as pinworm (Figure 1). In those 15 cases, age of patients ranged from 9 to 45 years with a mean age of  $19.07 \pm 9.04$  years. Out of those 15 patients, 11 (73.3%) were females and 4 (26.7%) were males. Male to female ratio was 1: 2.75. Only 2 out of 15 cases (13.3%) with parasitic infestation showed evidence of inflammation. On the other hand, out of 456 appendices without parasites, 324 (71.1%) were positive for inflammation (Table 1). This

difference was statistically significant with a p value  $<0.05$ .

## Discussion

Gastrointestinal infection due to *Enterobius vermicularis* occurs worldwide and is considered to be the most common helminth infection, especially in children younger than 12 years.<sup>16,17</sup> *E. vermicularis* is transmitted by fecal-oral route. The eggs enter the gastrointestinal tract and then hatch into larvae which differentiate into adult worms. This cycle takes approximately 6 weeks.<sup>18</sup> The infection is usually asymptomatic but the patient complains of perianal pruritus, lethargy, generalized weakness or abdominal colic.<sup>19</sup> Due to its low pathogenicity, *E. vermicularis* infestation is not considered to be a serious disease, but it has been associated with colitis, perianal abscess or granulomas, significant morbidity in females with ectopic infections, chronic pelvic pain, pelvic inflammatory disease and acute appendicitis.<sup>17</sup> However, the role of *E. vermicularis* in clinical appendicitis has been controversial since its discovery in the appendiceal lumen in 1898.<sup>20</sup>

According to this study finding parasites in surgically removed appendices is a rare occurrence, as only 3.18% of the specimens were found to contain the parasite, *E. vermicularis*. Globally, the reported incidence of *E. vermicularis* in patients with symptoms of appendicitis ranges from 0.2% to 41.8%.<sup>15</sup> A study done in the UK concluded that 13 (2.61%) of the 498 patients that underwent an appendectomy were diagnosed with the parasite *Enterobius vermicularis*.<sup>17</sup> On the other hand, parasitic infestation was identified in 12 (1.8%) out of 660 appendectomies performed, showed a much lower incidence.<sup>21</sup> Out of those 12 appendices with parasitic infestation, 9 had *Enterobius vermicularis*, whereas the remaining 3 had *Taenia*.<sup>21</sup> Another study done solely on children revealed a pinworm infection rate of 3.14% in appendices removed in Midwestern Regional Hospital, Limerick, Ireland.<sup>22</sup> The role of *E. vermicularis* as a cause of acute appendicitis has been controversial.<sup>14</sup> Some studies confirm the findings of inflammation in appendices found to have pinworms. Majority of the studies report a lower incidence of inflammatory changes in patients with appendiceal pinworms.<sup>23</sup> The reported rates of inflammation in specimens from appendices infested with *E. vermicularis* range from 13% to 37%.<sup>15</sup> In our study, 2 out of 15 cases (13.3%) showed evidence of inflammation. In Greece, a retrospective study showed similar results that only 1 out of 7 appendices with pinworms was positive for inflammation.<sup>24</sup> However, it is unclear that whether

the inflammatory infiltrates are present because of the parasite or if the pinworms are incidental findings in appendices where inflammation is already present.<sup>15</sup> Parasites obstructing the lumen of the appendix can result in symptoms mimicking acute appendicitis,<sup>25</sup> but histopathological examination may not reveal findings of acute inflammation,<sup>11,26</sup> as shown by our study results. As already mentioned, pinworm infestation without inflammatory reaction is considered to be a component of false acute appendicitis and the removal of a pathologically normal appendix is termed as negative appendectomy.<sup>27</sup> It is still a matter of debate among surgeons who perform laparoscopic appendectomy that whether an appendix appearing normal macroscopically with no other alternate pathology, should be removed. If the appendix is not acutely inflamed, appendectomy should be done carefully as there is a possibility of *E. vermicularis* infection and hence a risk of peritoneal contamination.<sup>17</sup> When suspected, these patients should be clinically observed and re-evaluated before considering appendectomy.<sup>10,17</sup> Pinworm is most commonly diagnosed with the Scotch tape test which involves pressing the strip of cellophane tape over the anal area and examining under the microscope for eggs.<sup>16,28</sup> For pinworm infection the drug of choice is either albendazole, mebendazole or pyrantel pamoate.<sup>16</sup>

## Conclusion

1. Frequency of parasitic infestations in surgically removed appendices is low.
2. Very few appendices with parasitic infestation are associated with inflammation as compared to appendices without parasites.

## References

1. Sinnatamby C, Last R. Last's anatomy. Edinburgh: Churchill Livingstone/Elsevier; 2011.
2. Williams N, Bulstrode C, O'Connell P. Bailey & Love's Short Practice of Surgery 26E. Hoboken: CRC Press; 2013.
3. Khan GM, Grillo IA, Abu-Eshy SA, Khan AR, Mubarak J. Pathology of the appendix. *J Natl Med Assoc* 2000; 92: 533-35.
4. Zakaria OM, Zakaria HM, Daoud MY. Parasitic infestation in pediatric and adolescent appendicitis: a local experience. *Oman Med J* 2013; 28: 92-96.
5. Ahmadi MH, Seifmanesh M. Taeniasis caused appendicitis without local tenderness: a rare case. *Hospital Chronicles* 2011; 6: 207-09.
6. Yabanoğlu H, Aytaç HÖ, Türk E. Parasitic infections of the appendix as a cause of appendectomy in adult patients. *Türkiye Parazitol Derg* 2014; 38: 12-16.
7. Thanikachalam MP, Kasemsuk Y, Mak JW. Study of parasitic infections in the luminal contents and tissue sections of appendix specimens. *Trop Biomed* 2008; 25: 166-72.
8. Flum D, Koepsell T. The Clinical and Economic Correlates of Misdiagnosed Appendicitis. *Archives of Surgery*. 2002;137(7):799-804.
9. Yildirim S, Nursal T, Tarim A, Kayaselcuk F. A rare cause of acute appendicitis: Parasitic infection. *Scandinavian Journal of Infectious Diseases*. 2005;37(10):757-59.
10. Aydin Ö. Incidental parasitic infestations in surgically removed appendices: a retrospective analysis. *Diagnostic Pathology*. 2007;2(1):16-19.
11. Çallı G, Özbilgin M, Yapar N, Sarioğlu S, Özkoç S. Acute appendicitis and coinfection with enterobiasis and taeniasis: a case report. *Türkiye Parazitol Derg* 2014; 38: 58-60.
12. Nordstrand IAJ, Jayasekera LK. Enterobius vermicularis and clinical appendicitis: worms in the vermiform appendix. *Aust N Z J Surg* 2004; 74:1024e5.
13. Akbulut S, Tas M, Sogutcu N. Unusual histopathological findings in appendectomy specimens: a retrospective analysis and literature review. *World J Gastroenterol* 2011; 17: 1961-70.
14. Surmont I, Liu L. Enteritis, eosinophilia, and Enterobius vermicularis. *The Lancet*. 1995;346(8983):1167-70.
15. Dahlstrom J, Macarthur E. Enterobius vermicularis: a possible cause of symptoms resembling appendicitis. *Pathology*. 1993;25:5-8.
16. Levinson W. Review of Medical Microbiology and Immunology 14E. New York: McGraw-Hill Education; 2016.
17. Ariyathenam A, Nachimuthu S, Tang T. Enterobius vermicularis infestation of the appendix and management at the time of laparoscopic appendectomy. *International Journal of Surgery*. 2010;8(6):466-69.
18. Markell E, Voge M, John D. Enterobius vermicularis In *Medical Parasitology*. Philadelphia: WB Saunders Company. 1992;268-70.
19. Chaudhary R, Shukla A. Pin Worm Causing Acute Appendicitis: Case Report. *Surgery: Current Research*. 2016;06(03): 265-66
20. Wiebe BM. Appendicitis and Enterobius vermicularis. *Scand J Gastroenterol*; 1991; 26: 336-38.
21. Altun E, Avci V, Azatçam M. Parasitic infestation in appendicitis. A retrospective analysis of 660 patients and brief literature review. *Saudi Medical Journal*. 2017;38(3):314-18.
22. Akhigbe T, Smith F, Adeyemo A, Adeyanju T, Condon E, Waldron D. Pinworm And Appendicitis In Children. *The Internet Journal of Surgery* 2013;30( 3): 176-83
23. Panidis S, Paramythiotis D, Panagiotou D, Batsis G, Salonikidis S. Acute appendicitis secondary to Enterobius vermicularis infection in a middle-aged man: a case report. *Journal of Medical Case Reports*. 2011;5(1):
24. Gialamas E, Papavramidis T, Michalopoulos N, Karayannopoulou G. Enterobius vermicularis: A rare Cause of Appendicitis. *Turkish Journal of Parasitology*. 2012;36(1):37-40.
25. Karatepe O, Adas G, Tukenmez M, Battal M. Parasitic infestation as cause of acute appendicitis. *G Chir* 2009; 30: 426-28.
26. İlhan E, Senlikci A, Kızanoğlu H. Do intestinal parasitic infestations in patients with clinically acute appendicitis increase the rate of negative laparotomy? Analysis of 3863 cases from Turkey. *Prz Gastroenterol* 2013; 8: 366-69.
27. Balthazar E, Rofsky N, Zucker R. Appendicitis: the impact of computed tomography imaging on negative appendectomy and perforation rates. *The American Journal of Gastroenterology*. 1998;93(5):768-71.
28. Pinworm test: MedlinePlus Medical Encyclopedia .Medlineplus.gov. 2018.