



Parasitic Infestation in Patients Undergoing Appendectomy: Retrospective Analysis of 7,344 Cases

Apendektomi Uygulanan Hastalarda Parazitik İstila: 7.344 Olgunun Retrospektif Analizi

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ABSTRACT

Aim: To evaluate the incidence, type and relationship with inflammation of parasitic infestation in patients undergoing appendectomy based on histopathological data.

Method: Retrospective examination was made of 7,344 appendectomy specimens. Parasitic infestation cases were evaluated in respect of age, gender, type of parasite and its relationship with inflammation.

Results: Evidence was found as to the presence of parasites was in 24 (0.32%) of the appendectomy materials examined. *Enterobius vermicularis* was observed in 22 and *Ascaris lumbricoides* in 2 of the cases. The patients with parasitic infestation comprised 12 (50%) males and 12 (50%) females with a mean age of 36.5 years (range: 12-74 years). Inflammation was observed in 8 (33.3%) patients and not observed in 16 (66.7%) patients.

Conclusion: Acute appendicitis may be caused by parasites. Negative appendectomy rates were higher in patients with parasite in appendix lumen. However, it remains controversial whether every parasite infestation causes an appendicitis inflammatory response.

Keywords: Acute appendicitis, *Enterobius vermicularis*, parasite

ÖZ

Amaç: Apendektomi geçiren hastalarda parazitik enfestasyon insidansını, türünü ve enflamasyonla ilişkisini histopatolojik verilere dayanarak değerlendirmek.

Yöntem: 7.344 apendektomi örneğinin retrospektif incelemesi yapıldı. Parazitik enfestasyon olguları yaş, cinsiyet, parazit tipi ve enflamasyonla ilişki açısından değerlendirildi.

Bulgular: İncelenen apendektomi materyallerinin 24'ünde (%0,32) parazit varlığına dair kanıt bulundu. Olguların 22'sinde *Enterobius vermicularis* ve 2'sinde *Ascaris lumbricoides* görüldü. Parazit istilası olan hastalar 12 (%50) erkek ve 12 (%50) kadını ve yaş ortalaması 36,5 yıl (aralık: 12-74 yaş) idi. Sekiz (%33,3) hastada enflamasyon görülürken, 16'sında (%66,7) enflamasyon görülmedi.

Sonuç: Akut apandisit parazitlerden kaynaklanabilir. Apendiks lümeninde parazit bulunan hastalarda negatif apendektomi oranları daha yüksekti. Bununla birlikte, her parazit istilasının apandisit iltihabına neden olup olmadığı tartışmalıdır.

Anahtar Kelimeler: Akut apandisit, *Enterobius vermicularis*, parazit

Introduction

The appendix vermiformis (AV) is a narrow, blind-ended tubular organ connected to the cecum. Inflammation of the AV is known as acute appendicitis, and this is one of the most common inflammatory diseases of the gastrointestinal tract. A decrease in blood flow caused by obstruction in

the appendiceal lumen, mucosal ischaemic damage and development of bacterial infection has influenced the pathogenesis of acute appendicitis. Acute inflammation is not observed in approximately 20% of patients undergoing appendectomy.¹

Lymphoid hyperplasia, faecalites, fruit and vegetable seeds, barium enemas and tumours are the main components of the



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aetiology of acute appendicitis. Although parasites have been reported to cause appendicitis only by occluding the lumen with acute inflammation or by creating an inflammatory reaction, the role of parasites in the pathogenesis of appendicitis has not been clearly defined.^{2,3} *Enterobius vermicularis* (EV), *Ascaris lumbricoides* (AL), *Schistosoma* spp. and *Taenia* spp. are parasites that can cause acute appendicitis. Among these, the most widespread cause of acute appendicitis is EV.^{4,5}

This study aimed to retrospectively evaluate patients with parasitic infestation who underwent appendectomy and were diagnosed with acute appendicitis.

Materials and Method

Electronic records of 7,344 patients who underwent appendectomy and who had acute appendicitis were analysed

retrospectively. The analysis covered the period from January 2009 to January 2020. The study was performed in Ankara Training and Research Hospital General Surgery Clinic. For this type of study, informed consent is not required. Patients with parasitic infestation were evaluated in terms of age, gender, type of parasite and presence of inflammation.

Results

A total of 7,344 patients underwent appendectomy. Parasites were seen in 24 appendectomy specimens. Among those with parasitic infestation, 12 (50%) were men and 12 (50%) were women, with a mean age of 36.5 (range: 12-74) years. EV was seen in 22 (91.6%) patients, and AL in 2 (8.4%) patients. Acute inflammation was observed in 7 (31.8%) of EV cases but not in 15 (68.2%). None of the AL cases had signs of acute inflammation (Table 1).

Table 1. Demographic parameters and histological findings of the patients

No. of case	Age	Gender	Species of parasite	Acute inflammation	Non-acute inflammation (negatif laparotomi)
1	38	Female	<i>Enterobius vermicularis</i>	No	Yes
2	31	Female	<i>Enterobius vermicularis</i>	No	Yes
3	30	Female	<i>Enterobius vermicularis</i>	Yes	No
4	23	Female	<i>Enterobius vermicularis</i>	Yes	No
5	20	Female	<i>Enterobius vermicularis</i>	No	Yes
6	19	Female	<i>Enterobius vermicularis</i>	No	Yes
7	27	Male	<i>Enterobius vermicularis</i>	Yes	No
8	64	Male	<i>Enterobius vermicularis</i>	No	Yes
9	29	Male	<i>Enterobius vermicularis</i>	No	Yes
10	34	Female	<i>Enterobius vermicularis</i>	No	Yes
11	29	Female	<i>Enterobius vermicularis</i>	No	Yes
12	27	Male	<i>Enterobius vermicularis</i>	No	Yes
13	59	Male	<i>Enterobius vermicularis</i>	Yes	No
14	27	Female	<i>Enterobius vermicularis</i>	Yes	No
15	48	Male	<i>Ascaris</i>	No	Yes
16	31	Female	<i>Enterobius vermicularis</i>	No	Yes
17	54	Male	<i>Enterobius vermicularis</i>	Yes	No
18	41	Male	<i>Enterobius vermicularis</i>	Yes	No
19	31	Female	<i>Ascaris</i>	No	Yes
20	36	Male	<i>Enterobius vermicularis</i>	No	Yes
21	74	Male	<i>Enterobius vermicularis</i>	No	Yes
22	50	Female	<i>Enterobius vermicularis</i>	No	Yes
23	44	Male	<i>Enterobius vermicularis</i>	No	Yes
24	12	Male	<i>Enterobius vermicularis</i>	No	Yes

Discussion

Acute appendicitis is the most frequently observed condition that requires emergency surgery.⁶ Acute appendicitis most commonly occurs in the second and third decades of life and affects approximately 8.6% of men and 6.7% of women.⁷ Acute appendicitis can be caused by parasites, as they occlude the appendiceal lumen or lead to secondary inflammation.⁸ Acute inflammation findings may not be present in the histopathological examination of appendectomy specimens of parasitosis.⁹ Karatepe et al.⁸ showed that inflammation was not found in 25% of appendectomy specimens, while İlhan et al.¹⁰ reported a rate of 52.7%. In the present study, acute inflammation findings were not observed in 70.9% of appendectomy specimens with parasite invasion (Table 2).

EV is the most frequent helminthic infection worldwide and is transmitted through faecal-oral transmission.¹¹ In general, it is a common intestinal parasite in boys and girls and is more common in underdeveloped countries and regions with low socioeconomic status.¹² Most people infected with *EV* are asymptomatic. Nevertheless, if symptoms develop, the most frequent one is anal pruritus.¹³ In addition, *EV* infections cause ileocolitis, enterocutaneous fistulas, urinary tract infections, mesenteric abscess, salpingitis and acute appendicitis. Mature forms of *EV* are most often located in the ascending colon, cecum, appendix and terminal ileum.^{14,15} The relationship between *EV* and acute appendicitis was first discovered at the end of the 19th century.¹⁶ Studies have established that *EV* caused pathological changes in the appendix, including lymphoid hyperplasia to acute phlegmatic appendicitis, gangrene appendicitis and peritonitis.⁴ In other studies, *EV* is present in 0.35%-12.5% of specimens of patients undergoing appendectomy for acute appendicitis.^{12,13,14,15,16,17} Akkapulu and Abdullazade¹⁸ reported an *EV* incidence rate of 0.62%. In present study, the incidence of *EV* was 0.32%. Appendectomy is not an adequate treatment for cases with *EV*, since it does not eliminate the main cause in these patients and anti-helminthic treatment

should also be administered.¹⁹ In the present study, anti-helminthic treatment was given to patients with parasites.

Study Limitations

Ascariasis is one of the most common helminthic diseases and is most commonly caused by *AL*. It is most common in the jejunum and proximal ileum. *AL* can often mimic acute appendicitis clinically, but rarely causes acute appendicitis. In a retrospective analysis of 324 appendectomy specimens, *AL* was detected in only 3 (0.9%) patients; none of whom had histopathological findings of acute appendicitis.²⁰ Wani et al.²¹ showed that while histopathological findings of acute appendicitis were not observed in 8 (72.7%) of 11 patients with *AL*, acute appendicitis findings related to ascariasis were detected in 3 (27.2%) patients. In the present study, *AL* was seen in only two patients, neither of which had any histopathological findings associated with acute appendicitis.

Conclusion

In conclusion, parasites are among the possible aetiological causes of acute appendicitis. *EV* is the most common parasite in specimens of patients undergoing appendectomy. Negative laparotomy rates have been seen to be higher in the presence of parasitic invasion in the appendix. To reduce negative laparotomy rates and to minimise related side effects, patients with abdominal pain should be checked whether they have intestinal parasites, and this should be considered in the differential diagnosis. Patients with parasitic infestations should be given anti-helminthic therapy.

Ethics

Ethics Committee Approval: Ankara Training and Research Hospital Ethics Committee (date: 15.01.2021/no: 542).

Informed Consent: Retrospective study.

Peer-review: Externally peer reviewed.

Table 2. Data obtained from countries included in this study

Author	Country	Total materials	Total, n (%)	Acute inflammation, n (%)	No acute inflammation, n (%)
Karatepe et al. ⁸	Turkey	5,100	24 (0.5)	18 (75)	6 (25)
de Silva et al. ⁴	Brazil	1,600	24 (1.5)	12 (50)	12 (50)
Zakaria et al. ²	Saudi Arabia	1,600	88 (5.5)	54 (61.4)	34 (38.6)
Gialamas et al. ¹⁴	Greece	1,085	7 (0.64)	1 (14.3)	6 (85.7)
Ilhan et al. ¹⁰	Turkey	3,863	19 (0.49)	9 (47.4)	10 (52.6)
Current study	Turkey	7,344	24 (0.33)	7 (29.1)	17 (70.9)

Authorship Contributions

Surgical and Medical Practices: K.K., A.Ş., M.S., A.D., Concept: K.K., A.D., Design: K.K., M.S., Data Collection or Processing: K.K., M.S., Analysis or Interpretation: K.K., A.Ş., A.D., Literature Search: K.K., A.Ş., Writing: K.K., A.Ş.

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References

1. Becker K, Höfler H. Pathology of appendicitis. *Chirurg* 2002;73:777-781.
2. Zakaria OM, Zakaria HM, Daoud MY, Wadaani HA, Buali WA, Al-Mohammed Al H, Mulhim SA, Zaki W. Parasitic infestation in pediatric and adolescent appendicitis: a local experience. *Oman Med J* 2013;28:92-96.
3. Ahmadi MH, Seifmanesh M. Taeniasis caused appendicitis without local tenderness: a rare case. *Hospital Chronicles* 2011;6:207-209.
4. de Silva DF, da Silva RJ, da Silva MG, Sartorelli AC, Rodrigues MAM. Parasitic infection of the appendix as a cause of acute appendicitis. *Parasitol Res* 2007;102:99-102.
5. Pasupati TM, Yothasamutr K, Wah MJ, Sherif SET, Palayan K. A study of parasitic infections in the luminal contents and tissue sections of appendix specimens. *Tropical Biomedicine* 2008;25:166-172.
6. Lally KP, Cox CS, Andrassy RJ (2004) The appendix. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL (eds) Sabiston textbook of surgery, 17th edn. WB Saunders, Philadelphia, pp 1381-1399.
7. Ahmadi MH, Seifmanesh M. Taeniasis caused appendicitis without local tenderness: a rare case. *Hospital Chronicles* 2011;6:207-209.
8. Karatepe O, Adas G, Tukenmez M, Battal M, Altioğ M, Karahan S. Parasitic infestation as cause of acute appendicitis. *G Chir* 2009;30:426-428.
9. Çallı G, Özbilgin M, Yapar N, Sarıoğlu S, Özkoç S. Acute appendicitis and coinfection with enterobiasis and taeniasis: a case report. *Turkiye Parazit Derg* 2014;38:58-60.
10. İlhan E, Senlikci A, Kızanoğlu H, Ustuner MA, Vardar E, Aykas A, Yeldan E, Yıdırım M. 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;8:366-369.
11. Vleeschouwers W, Hofman P, Gillardin JP, Meert V, Van Slycke S. Appendicitis-like clinical image elicited by *Enterobius vermicularis*: case report and review of the literature. *Acta Chir Belg* 2013;113:139-142.
12. Engin O, Calik S, Calik B, Yildirim M, Coskun G. Parasitic appendicitis from past to present in Turkey. *Iranian Journal of Parasitology* 2010;5:57-63.
13. Alemayehu H, Snyder CL, St Peter SD, Ostlie DJ. Incidence and outcomes of unexpected pathology findings after appendectomy. *J Pediatr Surg* 2014;49:1390-1393.
14. Gialamas E, Papavramidis T, Michalopoulos, Karayannopoulou G, Cheva A, Vasilaki O et al. *Enterobius vermicularis*: a rare cause of appendicitis. *Turkiye Parazit Derg* 2012;36:37-40.
15. Sodergren MH, Jethwa P, Wilkinson S, Kerwat R. Presenting features of *Enterobius vermicularis* in the vermiform appendix. *Scand J Gastroenterol* 2009;44:457-461.
16. Stil GF. Oxyuriasis vermicularis in children. *Br Med J* 1899;1:898-900.
17. Isik B, Yılmaz M, Karadag N, Kahraman L, Sogutlu G, Yılmaz S, Kirimlioglu V. Appendiceal *Enterobius vermicularis* infestation in adults. *Int Surg* 2007;92:221-225.
18. Akkapulu N, Abdullazade S. Is *Enterobius vermicularis* infestation associated with acute appendicitis? *Eur J Trauma Emerg Surg* 2016;42:465-470.
19. Nackley AC, Nackley JJ, Yeko TR, Gunasekaran S. Appendiceal enterobius vermicularis infestation associated with right-sided chronic pelvic pain. *JSLs* 2004;8:171-173.
20. Chamisa I. A clinicopathological review of 324 appendices removed for acute appendicitis in Durban, South Africa: A retrospective analysis. *Ann R Coll Surg Engl* 2009;91:688-692.
21. Wani I, Maqbool M, Amin A, Shah F, Keema A, Singh J, Kitagawa M, Nazir M. Appendiceal ascariasis in children. *Ann Saudi Med* 2010;30:63-66.