


Unusual Histopathological Findings in Appendectomy Specimens: A Retrospective Analysis of 2047 Cases

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Nurcan Unver¹ , Ganime Coban¹, Dilek Sema Arıcı¹,
Nur Buyukpınarbasılı¹, Zuhale Guçin¹, Fatma Ümit Malya²,
Oyku Izel Onaran³, and Kivanc Topalan⁴

Abstract

Background. In this study, we retrospectively evaluated cases of patients who had undergone appendectomy in our hospital and aimed to present the efficiency of diagnostic tests and demographic data of cases. Pathological reports were analyzed for the following parameters: age, gender, and pathological diagnosis. In addition, the demographic and clinicopathologic characteristics of patients with unusual histopathologic findings were evaluated in detail, and reanalysis of archived resected appendix specimens was carried out. **Methods.** Files of 2047 patients (1329 males, 718 females, sex ratio: 1.85, age range: 1–87 years, mean age: 26, 50 years), who had been operated with a diagnosis of acute appendicitis in the emergency department of Bezmialem Vakıf University Medical Faculty from November 2011 to June 2014, were retrospectively evaluated. **Results.** Cases were separated into 2 groups. Cases with histopathologic examination reported as acute appendicitis constituted group 1 (n = 2013, 98.34%), and cases with pathologic findings other than acute appendicitis constituted group 2 (n = 34, 1.66%). The second group consisted of 8 low-grade mucinous neoplasms, 7 mucocoeles, 6 carcinoid, 5 granulomatous inflammation, 4 intraluminal *Enterobius vermicularis*, 1 endometriosis externa, 1 adenocarcinoma infiltrated to serosa, 1 mesenteric cyst, and 1 low-grade adenocarcinoma formed in mucinous cystic neoplasm background. **Conclusion.** Acute appendicitis is the most common emergency surgical condition. Although most of the resected appendectomy specimens showed typical histopathologic findings, some (1.66%) showed unusual histopathologic findings. Even if the macroscopic appearance of the specimen is normal or acute appendicitis, we suggest routine histopathological examination.

Keywords

appendicitis, appendectomy specimens, unusual findings, carcinoid tumor, *Enterobius vermicularis*

Introduction

Appendicitis remains one of the most common acute conditions of the abdomen, and suspected cases are frequently treated with emergency appendectomy.^{1–3} The complete organ excision not only allows for definitive diagnosis but also significantly reduces the risk of life-threatening complications, such as perforation, plastron, and sepsis. Epidemiological studies have revealed that the incidence of acute appendicitis roughly parallels that of lymphoid development, with the peak incidence occurring between the ages of 10 and 30 years. The most important causative factor of acute appendicitis appears to be development of luminal obstruction—fecalith plugs are the most common factor.^{1,2,4–6}

The aim of this study was to assess the value of routine histological examination of the resected appendix and study the unusual histopathological findings detected in

appendectomy specimens from patients who received surgery to address an initial diagnosis of acute appendicitis.

Materials and Methods

A retrospective study was done of all histopathological reports of appendectomy specimens operated between

¹Bezmialem Vakıf University, Faculty of Medicine, Department of Pathology, Turkey

²Bezmialem Vakıf University, Faculty of Medicine, Department of General Surgery, Turkey

³Kesan Community Health Center, Edirne, Turkey

⁴Bezmialem Vakıf University, Faculty of Medicine, Turkey

Corresponding Author:

Nurcan Unver, Bezmialem Vakıf University Faculty of Medicine, Vatan Street, Istanbul 34093, Turkey.

Email: pat.dr.nurcanunver@gmail.com

Table 1. Distribution of the 34 Cases Defined as “Unusual Finding” According to Etiological Causes.

Unusual Finding	N = 34 (1.66%), n (%)
Low-grade mucinous neoplasm	8 (0.39%)
Mucoceles (retention cysts)	7 (0.34%)
Carcinoid tumor(neuroendocrine tumor, grade 1)	6 (0.30%)
Granulomatous inflammation	5 (0.245%)
Intraluminal <i>Enterobius vermicularis</i>	4 (0.20%)
Endometriosis externa	1 (0.49%)
Adenocarcinoma infiltrated to serosa	1 (0.49%)
Mesenteric cyst	1 (0.49%)
Low-grade adenocarcinoma formed in mucinous cystic neoplasm background	1 (0.49%)

November 2011 and June 2014 for a clinical suspicion of acute appendicitis in the emergency department of Bezmialem Vakıf University Medical Faculty, İstanbul, Turkey. Pathological reports were analyzed for the following parameters: age, gender, and pathological diagnosis. Patients who had appendectomy incidental to other surgeries, such as colorectal or gynecological cancer surgery or trauma surgery, were excluded from study enrollment. In our department, appendectomy specimens are routinely sampled for both macroscopic and microscopic examination. Using the microscopic findings of each patient's appendectomy specimen that were recorded in the pathology report, patients were classified into 1 of 2 categories: acute appendicitis with usual pathologic findings (group 1) and others with pathological abnormalities (group 2).

Unusual histopathological findings included low-grade mucinous neoplasm, retention cysts, neuroendocrine tumor, granulomatous inflammation, *Enterobius vermicularis*, endometriosis externa, and adenocarcinoma. In light of this, it could be said that the second group did not include fibrous obliteration and lymphoid hyperplasia of the appendix. For this study, the follow-up period was calculated as months from the date of appendectomy until the final clinical information was reported in the electronic database, or up to June 2014.

Results

We studied files of 2047 patients (1329 males [64.9%], 718 females [35.1%], sex ratio: 1.85, age range: 1-87 years, mean age of the patients: 26, 50 years), who had been operated with a diagnosis of acute appendicitis in the emergency department of Bezmialem Vakıf University Medical Faculty from November 2011 until June 2014.

According to our data, there were 2013 (98.34%) patients in group 1, acute appendicitis with usual causes, and 34 (1.66%) patients who received appendectomy to treat the initial diagnosis of acute appendicitis and had unusual histopathological findings in their appendectomy specimens (Table 1). We had just 1 patient who was negative appendicitis.

The findings of these 34 patients (group 2) with unusual histopathological findings included low-grade mucinous neoplasm (n = 8), mucoceles (n = 7), carcinoid tumor (n = 6), granulomatous inflammation (n = 5), intraluminal *Enterobius vermicularis* (n = 4), endometriosis externa (n = 1), adenocarcinoma infiltrated to serosa (n = 1), mesenteric cyst (n = 1), and low-grade adenocarcinoma formed in mucinous cystic neoplasm background (n = 1).

In 6 of the 34 patients, the final pathological diagnosis was G1 neuroendocrine tumor according to the World Health Organization 2010 recommendation.^{7,8} One patient had adenocarcinoma overlapping with a mucinous neoplasia (Figure 1F), which was pT1Nx with positive distal margin, and 8 patients had low-grade mucinous neoplasia according to the PSOGI 2016 (Peritoneal Surface Oncology Group International) classification (Figure 1E).⁹ Six specimens were reported as neuroendocrine tumor. All of them were grade 1 according to the World Health Organization 2010 classification (Figure 1C and D). The median tumor diameter was 6 mm (2-19 mm). Seven simple mucocele cases caused by inflammatory conditions without mucosal hyperplasia were excluded from this neoplastic group (retention cyst). All of the materials were sampled.

Discussion

Appendectomy is one of the most frequently performed surgical procedures worldwide. In institutions, it is a general rule to send all surgical specimens for routine histopathologic evaluation. In this setting, appendectomy specimens represent nearly one fifth of all specimens analyzed in pathology.⁷ Many studies have 5 pathological groups with consequential diagnoses encountered in appendices specimens: parasite infection, endometriosis, granulomatosis, benign neoplasm, and premalignant/malignant neoplasm.^{3,10} Medical textbooks still teach the doctrine that the main cause of appendicitis is obstruction of the lumen of the appendix by lymphoid hyperplasia or fecoliths. The former is considered the main cause in

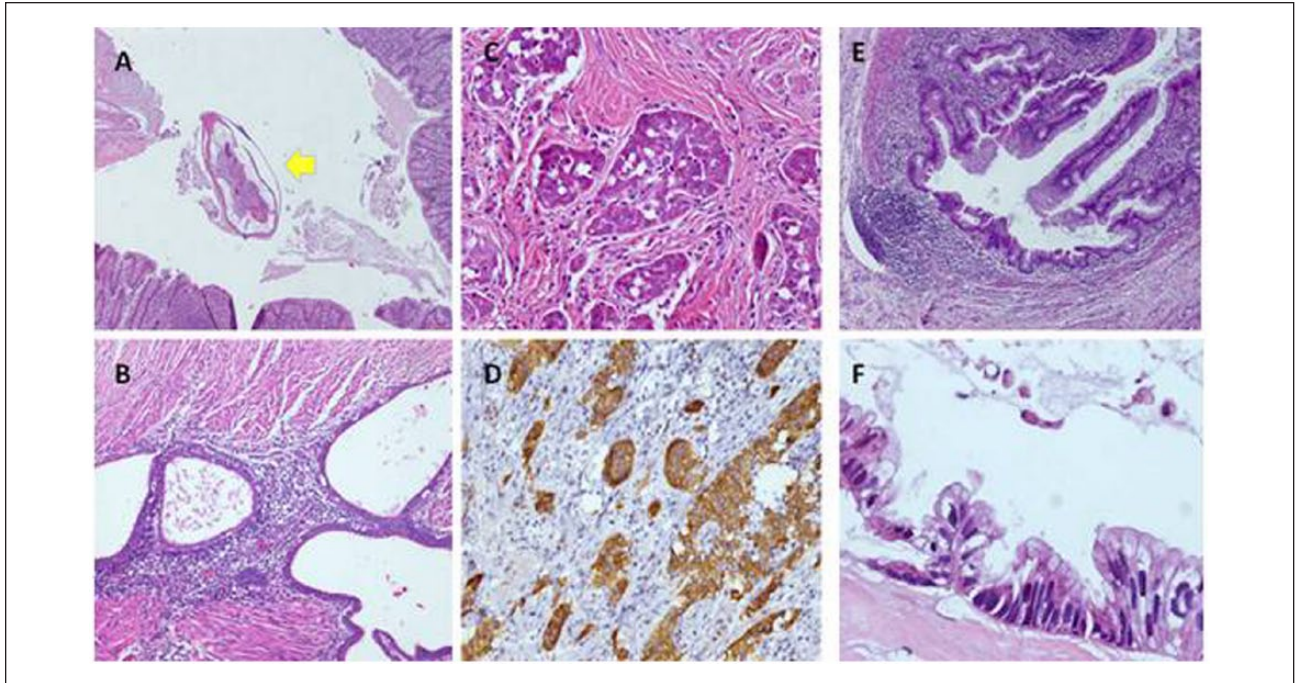


Figure 1. Unusual histopathologic findings. (A) *Enterobius vermicularis* image within the lumen of the appendix (yellow arrow; hematoxylin-eosin [H&E], $\times 40$). (B) Appendiceal endometriosis. Focus of endometriosis-containing endometrial glands and stroma in appendiceal wall (H&E, $\times 100$). (C) Carcinoid tumor in appendix (H&E, $\times 100$). (D) Carcinoid tumor positive synaptophysin immunohistochemistry ($\times 100$). (E) Low-grade mucinous neoplasm (H&E, $\times 100$). (F) Low-grade adenocarcinoma (H&E, $\times 200$).

children and the latter in adults, although foreign bodies, parasites, and tumors have also been implicated.¹¹⁻¹⁴ Fecolith prevalence is too low to consider the fecolith the most common cause of nonperforated appendicitis. Fecoliths are more prevalent in pediatric appendicitis than in adult appendicitis.⁴

The aim of this study was to analyze the clinical benefit of histopathologic analysis of appendectomy specimens from patients with an initial diagnosis of acute appendicitis, because of the fact that malignant neoplasms, some endocrine tumors, parasitic infection, and granulomatous inflammation need further exploration and adequate treatment.^{1-3,10}

The incidence of negative appendectomies has been reported to be on the decline over the past years as our study also supports.^{2,3,15} In our study, negative appendectomy was present in just one patient. Many factors might explain the decrease of the rate of negative appendectomy. The use of computed tomography scans preoperatively has been shown to reduce the rate of negative appendectomy. Moreover, laparoscopy is also a useful diagnostic adjunct, yet it is known that clinical suspicion is enough to diagnose acute appendicitis. On the other hand, other studies have shown that 70% of negative appendectomies were in females.^{1,2,16} Actually, this reflects the difficulties in diagnosing acute appendicitis in female patients because of the gynecological disorders that mimic acute appendicitis.²

The most common of these unusual pathological diagnoses are mucinous cystadenoma or mucocele,¹⁰ carcinoid tumor,^{2,8,10,16,17} granulomatous diseases,^{10,16,18} enterobiasis,^{5,19-21} taeniasis,²² ascariasis,²³ diverticulitis,²⁴ primary or secondary adenocarcinoma,^{25,26} and lymphoma.²⁷ The most frequently diagnosed type of appendiceal primary malignant lesion is the carcinoid tumor. Although it accounts for about 60% of all appendiceal tumors, its incidence in patients undergoing appendectomy is only 0.30% to 2.27%. Our study shows that 0.30% ($n = 6$) patients had undergone appendectomy because of carcinoid tumor. Fortunately, malignancy and metastasis of these tumors are very rare. Therefore, simple appendectomy is considered sufficient management for these tumors.

Adenocarcinoma of the appendix is a very rare tumor, with overall incidence in the literature between 0.01% and 0.20%. In our patient series, only 2 patients (the first one is adenocarcinoma infiltrated to serosa, and the second one is low-grade adenocarcinoma formed in mucinous cystic neoplasm background) presented with this tumor type, giving an incidence of 0.10%, which is similar to that in the overall literature.

Mucocele is a condition in which mucoid material accumulates in the intraluminal region of the appendix, causing obstructive dilatation of the organ. The overall incidence of this condition in the literature ranges from 0.2% to 0.7%. In our patient series, 7 patients presented

with mucocele, giving an incidence of 0.34%, which is similar to that in the literature.

Enterobius vermicularis, pinworm, is a parasitic infection. The association of pinworm infection and appendicitis or presumed appendicitis has ranged from 0.2% to 41.8%.^{1,2,16,18} In our study, the incidence of pinworms in the appendectomy specimens was 0.20% (n = 4; Figure 1A), which is similar to that in the literature.

Granulomatous appendicitis is rare condition that may be discovered incidentally in a patient with a clinical presentation of acute appendicitis. The reported incidence in Western countries has ranged from 0.14% to 0.30% and is higher (1.3% to 2.3%) in underdeveloped countries.¹⁰ In our study, 0.245% (n = 5) of the cases were found to be granulomatous appendicitis.

Endometriosis is defined as the presence of ectopic endometrial tissue outside of the uterine cavity. Although many women of reproductive age suffer from this disease, a gastrointestinal tract location is rare. Intestinal endometriosis is classified as external endometriosis and occurs in only ~10% of women with endometriosis. Most intestinal endometriosis occurs in the rectum and sigmoid colon, and occurrence in the appendix is rare. Although gynecologic causes is a common reason for negative appendectomy as mentioned before, endometriosis is usually asymptomatic. The histologic presence of endometrial tissue in the specimen is the basis for diagnosis of appendiceal endometriosis.^{1,28,29} There was only one (0.05%) case in our study as an example of this pathology (Figure 1B).

In our study, pathological diagnosis of one of the acute appendicitis patients was mesenteric cyst (n = 1; 0.049%).

Conclusions

Acute appendicitis is the most common emergency surgical condition. Early symptoms make diagnosis easier and contribute to lower rate of complications. On the other hand, abnormal pathological findings should not be left out, because the treatment approach may be altered according to the pathologic diagnosis.

Declaration of Conflicting Interests

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Ethical Approval

Not applicable, because this article does not contain any studies with human or animal subjects.

Informed Consent

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Trial Registration

Not applicable, because this article does not contain any clinical trials.

ORCID iD

Nurcan Unver  <https://orcid.org/0000-0001-7392-6099>

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