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Should histopathological evaluation of all appendectomy specimens essential?

Tüm apendektomi örneklerinin histopatolojik olarak değerlendirilmesi gerekli midir?

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Abstract

Aim: Acute appendicitis is a surgical emergency. While fecaliths and lymphoid hyperplasia are the most common etiological factors, some unexpected reasons can also be encountered. In order to evaluate the cause, all appendectomy specimens are routinely sent for pathological examination in our hospital. However, some studies question the routine sending of appendectomy specimens for pathological examination. The aim of this study is to appreciate whether routine pathological evaluation is necessary.

Methods: The histopathological reports of 1,358 patients who underwent appendectomy between February 2019 and July 2020 in Ankara City Hospital, were retrospectively evaluated. The rate of unestimated or unexpected findings was detected. It was evaluated whether unexpected findings were suspected clinically, radiologically and macroscopically. In addition, the effects of unexpected results on the treatment of the patient were identified.

Results: 811 male and 547 female were included in the study. Unexpected pathological findings were detected in 57 patients. Of the 14 patients suspected of having unexpected findings, six were confirmed pathologically, of which one was suspected by preoperative imaging methods and five were macroscopically suspected during surgery. While the presence of unexpected pathological findings caused additional medical treatment in two patients and additional surgical treatment in three patients, seven patients are still being followed up in different clinics.

Conclusion: We recommend that appendectomy specimens be routinely sent for pathological examination, as unexpected results that may affect the patient's health, may be missed without histopathological examination.

Key words: Acute appendicitis, appendectomy, appendectomy specimen, histopathologic evaluation, histopathologic diagnose, unexpected findings.

Öz

Amaç: Akut apandisit cerrahi acil bir durumdur. Fekalitler ve lenfoid hiperplazi en sık karşılaşılan etiyolojik nedenler olmakla birlikte bazı beklenmedik faktörlerle de karşılaşılmaktadır. Bunu tespit etmek amacıyla hastanemizde rutin olarak tüm apandektomi örnekleri patolojik incelemeye gönderilmektedir. Ancak bazı çalışmalar apandektomi örneklerinin rutin olarak patolojik incelemeye gönderilmesini sorgulamaktadırlar. Bu çalışmanın amacı, apandektomi örnekleri için rutin patolojik incelemenin gerekli olup olmadığını değerlendirmektir.

Yöntemler: Ankara Şehir Hastanesinde Şubat 2019-Temmuz 2020 tarihleri arasında apandektomi yapılan 1358 hastanın histopatolojik raporları retrospektif olarak değerlendirildi. Tahmin edilemeyen ya da beklenmedik histopatolojik sonuçların oranı, klinik, radyolojik ve makroskopik olarak şüphelenilip şüphelenilmediği ve ayrıca hastanın tedavisine etkileri tespit edilerek değerlendirme yapıldı.

Bulgular: Çalışmaya 811 erkek ve 547 kadın hasta dahil edildi. 57 hastada beklenmeyen patolojik sonuçlar tespit edildi. Beklenmedik sonuç çıkabileceğinden şüphelenilen 14 hastanın 6'sı patolojik olarak doğrulandı. Bunlardan 1'inden ameliyat öncesi görüntüleme yöntemleriyle ve 5'inden ameliyat sırasında makroskopik olarak şüphelenildi. Beklenmedik patolojik bulguların varlığı 2 hastada ilave medikal tedaviye, 3 hastada ise ek cerrahi tedaviye neden olurken, 7 hastanın farklı kliniklerde takibi halen daha devam etmektedir.

Sonuç: Histopatolojik inceleme yapılmadan hastanın sağlığını etkileyebilecek beklenmedik sonuçların gözden kaçabilme ihtimalinden dolayı, apandektomi örneklerinin rutin olarak patolojik incelemeye gönderilmesini öneriyoruz.

Anahtar Kelimeler: Akut apandisit, apandektomi, apandektomi materyali, histopatolojik değerlendirme, histopatolojik tanı, beklenmeyen bulgular.

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Introduction

Acute appendicitis is one of the most common surgical conditions of the abdomen in general surgery. It has disclosed in the studies that the incidence of acute appendicitis increases with the development of lymphoid tissue and it is more common in males, especially between the ages of 10 and 30 years. Luminal obstruction is the most important reason for ocuring accute appendicitis. While fecaliths are the most common etiological factors, some unexpected cases such as benign or malign tumors, intestinal worms, polyps, diverticulitis, endometriosis can also be included among causative factors [1-5].

Although sending appendectomy specimens for routine histopathological examination varies in different centers [6,7], it is accepted to sent routinely in our hospital. To our knowledge, there are scant number of articles evaluating the presence of unexpected findings by comparing age, gender and especially the diameter of appendix.

The aim of this study is to evaluate the unexpected findings in appendectomy specimens and identify whether routine histopathologic examination is needed or not.

Material and methods

All appendectomy specimens that underwent open or laparoscopic surgery with the suspicion of acute appendicitis between February 2019 and July 2020 in Ankara City Hospital, were retrospectively evaluated. The study protocol was approved (Ethics No: E1-21-1515) by the hospital ethics committee and the research was conducted according to the Declaration of Helsinki.

The patient's complaints, physical examination, laboratory results and imaging methods were evaluated together and decided to perform appendectomy. Ultrasound (US) was the first choice as the imaging modality, but computed tomography (CT) scan was considered in case of suspicion clinically or radiologically.

The demographic, operative and pathologic records such as gender, age, date of surgery, additional disease history, preoperative imaging studies, macroscobic and microscobic characteristics of appendix, primary or coexisting findings while surgery and need for additional postoperative treatment were analyzed for each patient. Patients under the age of 18, had incidental appendectomy while other surgeries, those with familial or chronic bowel disease such as crohn's, ulcerative colitis, familial adenomatous polyposis and additionally those with known metastatic or nonmetastatic malignancies were excluded from the study.

Appendectomy specimens were fixing in formalin before transporting to the pathology laboratory. A form containing the estimated diagnosis and suspicious findings stated in imaging methods and during surgery was also sent with the sample.

Those whose pathology results were reported as appendix vermiformis, lymphoid hyperplasia, fibrous obliteration were accepted as negative appendectomy, and those with acute appendicitis, phlegmonous appendicitis, gangrenous appendicitis, necrotizing appendicitis and perforated appendicitis were accepted as positive appendectomy. These patients were accepted as Group 1, other than these, such as the presence of polyp, parasite, cyst, diverticulum, endometriosis, granulomatous appendicitis, adenoma, mucinous neoplasm, neuroendocrine tumor, adenocarcinoma were evaluated as unexpected findings and accepted as Group 2.

Statistical Analysis

Statistical analyses were performed using SPSS version 25.0 (SPSS, Inc, Chicago, IL). Demographic, perioperative, and follow-up datas were analyzed with Mann-Whitney U test, Chi Square ($\chi 2$) test and Receiver Operating Characteristic (ROC) Curve analysis as appropriate. Continuous variables were presented as mean ± standard deviation. A *p* value of less than 0.05 was considered statistically signifcant.

Results

A total of 1478 patients who underwent appendectomy were screened, of whom totally 1358 patients, 811 (59.7 %) male and 547 (40.3 %) female, who met the criteria were included in the study. The ages of the patients ranged from 18 to 89 years with the mean age 34.9 ± 14.7 years old in men and 36.5 ± 15 years old in women.

After the histopathological examination of surgical specimens, 1183 (87.1 %) patients were diagnosed as appendicitis, and 118 (8.7 %) as negative appendectomy. Unexpected findings were detected in 57 (4.2%) patients. The patients with unexpected pathology, 28 (3.5%) were male and 29 (5.3%) were female, and no statistically significant difference could be detected. (p=0.096) The mean age in Group 1 was 35.1 ± 14.5 years old but it was 45.7 ± 18.6 years old in Group 2 and there was a statistically significant difference. (p<0.0001) In the evaluation with the regarding of the diameters of appendix stated in CT or US reports, the mean diameter was 13.3 ± 7 mm in the patients with unexpected pathological findings, while it was 10.3 ± 2.7 mm in the other group and was statistically significant. (p=0.002) When the effect of patient's age, gender, and appendix diameter on unexpected findings were evaluated with univariate and multivariate analyzes, and the age of patient and the diameter of appendix were found to be significantly effective in both univariate and multivariate analyses. (Tables 1-3)

Table 1: Characteristics of patients

Parameters	Group 1 (n=1,302)	Group 2 (n=57)	*p* value
Age. mean ± SD	35.1 ± 14.5	45.7 ± 18.6	<0.0001
Gender, n (%)			0.096
Male	783 (96.5)	28 (3.5)	
Female	518 (94.7)	29 (5.3)	
Diameter of appendix, cm, mean ± SD	10.3 ± 2.7	13.3 ± 6.9	0.002

SD: standard deviation

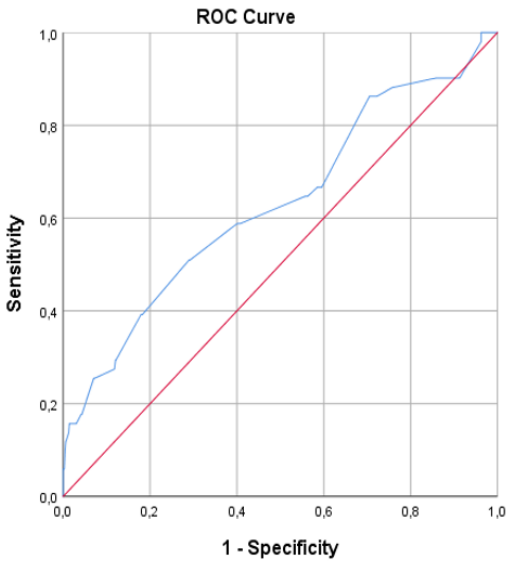

Figure 1. Graph showing the relationship between the diameter of appendix and unexpected results.

Table 2. Histopathological diagnosis of appendectomy specimens.

Histopathological Diagnosis	n (%)
Appendicitis	1,183 (87.1)
Acute appendicitis	731 (53.8)
Phlegmenous appendicitis	320 (23.6)
Gangrenous appendicitis	88 (6.5)
Necrotizing appendicitis	9 (0.7)
Perforated appendicitis	35 (2.6)
Normal appearing appendix vermiformis	118 (8.7)
Appendix vermiformis	22 (1.6)
Lymphoid hyperplasia	85 (6.3)
Fibrous obliteration	11 (0.8)
Unusual findings	57 (4.2)
Polyp	5 (0.4)
Parasites	3 (0.2)
Cyst	1 (0.1)
Diverticulosis	9 (0.7)
Endosalpingiosis	1 (0.1)
Endometriosis	2 (0.1)
Granulomatous appendicitis	5 (0.4)
Adenoma	8 (0.6)
Mucinous neoplasm	11 (0.8)
Neuroendocrine cell hyperplasia	1 (0.1)
Neuroendocrine tumor	10 (0.7)
Adenocarsinoma	1 (0.1)

Table 3. Evaluation of the factors affecting the unexpected findings.

Parameters	Univariate Analysis	Multivariate Analysis
	p value	p value
Gender (Male/female)	0.096	
Age	<0.001	<0.001
Diameter of appendix	<0.001	0.046

The ROC analysis shows the relationship between appendix diameters and age of patients in group 1 and group 2. As the cut-off values, the diameter of the appendix was 10.15 mm and the age of patient was 36.5 years, were detected. (AUC: 0.630, Sensitivity: 0.588, Specificity: 0.592, AUC: 0.670, Sensitivity: 0.614, Specificity: 0.644, respectively) According to this, the number of patients under the age of 37 with unexpected findings was 22 (2.6 %), while it was 35 (7 %) over the age of 37, and it was statistically significant. (p<0.0001) Similarly, the number of unexpected findings in patients with appendiceal diameter less than 10.15 mm was 21 (2.9 %), while it was 35 (5.8 %) for the patients with an appendiceal diameter greater than 10.15 mm and this was also statistically significant. (p=0.01) (Figure 1, Figure 2)

There were arosed a suspicion for unexpected findings in a total of 14 (1 %) patients, of whom seven were on preoperative imaging methods and seven were intraoperatively. The pathology results of six (42.9 %) of them were compatible with unexpected findings. It was stated that 5 (83.3 %) of these six patients were suspected intraoperatively. While it was decided that appendectomy was sufficient in 40 (70.2%) of 57 patients and that no additional treatment was needed, seven (17.5 %) of these patients are still being followed by gastroenterology, medical oncology and general surgery.

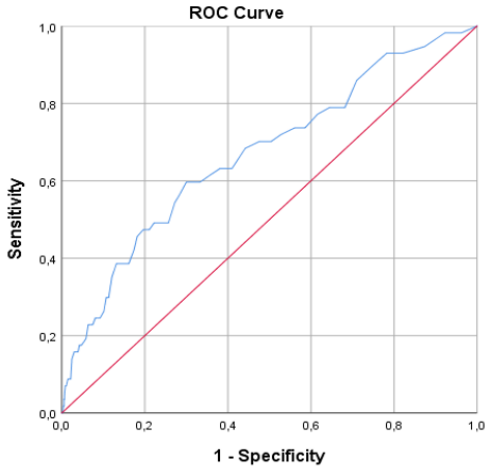

Figure 2. Graph showing the relationship between the age of patients and unexpected results

Additional treatments (E. vermicularis medical teratment in one patient, right hemicolectomy in three patients, Crohn's disease treatment in one patient) were applied to five (29.8 %) of the remaining 17 patients but other 12 patients were lost to follow-up.

Discussion

Appendectomy is one of the most common acute surgical procedure. Luminal obstruction of the appendix, especially with lymphoid hyperplasia or fecaliths, are the most common etiological factors for acute appendicitis mentioned in literatures and text books. But some unusual factors such as benign or malign tumors, parasites, foreign bodies, endometriosis, granulomatous pathologies could be detected [1, 5, 8]. In our study, we have defined 1,183 (87.1 %) acute appendicitis cases and 118 (8.7 %) negative appendectomy cases. In previous studies, unexpected results were found to vary between 0.7% and 8.3% [2, 5]. In this study, this rate was 4.2%, and was consistent with them.

The necessity of routine histopathological evaluation of the specimen after appendectomy is still confusing. The reason for this confusion is the contradiction between the thought that the presence of unexpected findings may change our treatment method and will create an economic burden due to low incidence [1, 2, 4, 6, 9]. In our center, we routinely send all resected appendectomy specimens for histopathological evaluation but some centers prefer to send if they are suspected clinically, radiologically or macroscopically [4, 6, 9, 10]. It was demonstrated in our study that there were a suspicion for unusual finding in only 14 (1%) patients, of whom 6 of them had pathology results consistent with suspicion. In other words, if we had sent only suspicious samples to pathological examination, we would have missed the results of the other 51 patients.

There are few studies reporting the association of unexpected results with age and gender. Akbulut et al. [8] defined in their study that most of the patients with unexpected findings were male (55.5 %) and the median age was 32.2 ± 15.1 years (15-84 years old). Ma et al. [11] reported that neoplastic lesions were mostly seen in men and over 50 years of age. [11] Elfaedy et al. [3] stated in their study that unusual finding was higher in > 30 year age group but unlike the previous two

studies, unexpected results were found to be more in female (7.1 %) gender. In our study, unexpected findings were found in 28 (3.5%) male and 29 (5.3%) female patients, but no statistically significant difference was detected. While the mean age of the group with unexpected findings was 45.7 ±18.6 years old, it was 35.1 ±14.5 years old in the other group, and a statistically significant difference was found. ($p<0.0001$) In addition to other studies, we have evaluated in our report whether there was a relationship between the diameters detected in preoperative imaging methods and unexpected results. The mean diameter detected in Group 1 was 10.3 ±2 .7 mm and it was 13.3 ±6 mm in Group 2 and this was statistically significant. ($p=0.002$) Moreover, we also calculated the cut-off values for both age (36.5 years) and appendix diameter (10.15 mm) in our study and above these values, unexpected results were found to be increased significantly.

Some studies have indicated that unexpected findings of the appendix can be suspected macroscopically, clinically or radiologically, while others have shown that they may be missed if pathological examination is not performed [6, 7, 9, 10]. In our study, as mentioned above that there were suspicion in only 14 (1%) patients, and only 6 of them were compatible with suspicion. Five (83.3 %) of these 6 patients were macroscopically suspected during surgery. As these results show, unexpected findings were not encountered in most of the suspected cases. In addition, when evaluation is made only macroscopically or with clinical or radiological data without pathological examination, the probability of detecting unexpected results will low.

In our study, histopathological examination directly affected the treatment process of 5 (8.8 %) patients (medical treatment, surgical treatment), while 7 patients were still being followed up by different clinics. Additionally, considering that 12 patients did not come to postoperative follow-up, the importance of histopathological evaluation would be understood more clearly.

The retrospective design of the study and the small sample size were considered as our limits. In addition, being covered a relatively short period of approximately 2 years and was not including the pediatric age group can be counted among our limits. Despite our limitations, we were able to reach some outcomes as a result of our work.

In conclusion, we think that the diagnosis of unexpected results without histopathological evaluation is challenging because of not having a typical clinical findings different from acute appendicitis, not making a definite diagnosis with preoperative imaging methods and not detecting macroscopically. Thus, considering the previous studies and the data we obtained from our own study, it was concluded that it would be appropriate to send all appendectomy specimens for histopathological evaluation, as it may directly affect the treatment protocol and, of course, the health status of the patient.

References

1. Unver N, Coban G, Arici DS, Buyukpinarbasili N, Gucin Z, Malya FU, et al. Unusual Histopathological Findings in Appendectomy Specimens: A Retrospective Analysis of 2047 Cases. Int J Surg Pathol. 2018: 1-5.
2. Duzgun AP, Moran M, Uzun S, Ozmen MM, Ozer VM, Seckin S, et al. Unusual findings in appendectomy specimens: Evaluation of 2458 cases and review of the literature. Indian J Surg. 2004;66:221-26.
3. Elfaedy O, Benkhadoura M, Elshaikhy A, Elgazwi K. Impact of routine histopathological examination of appendectomy specimens on patient management: a study of 4012 appendectomy specimens. Turk J Surg.2019;35:196-201.
4. Malhotra K, Bawa A. Routine Histopathological Evaluation After Appendectomy: Is It Necessary? A Systematic Review. Cureus. 2020;12: e9830.
5. Yilmaz M, Akbulut S, Kutluturk K, Sahin N, Arabaci E, Ara C, et al. Unusual histopathological findings in appendectomy specimens from patients with suspected acute appendicitis. World J Gastroenterol. 2013;19:4015-22.
6. Jones AE, Phillips AW, Jarvis JR, Sargen K. The value of routine histopathological examination of appendicectomy specimens. BMC Surgery. 2007;7:17.
7. Khan OA, Morhan A, Jegatheeswaran S, Jackson E, Pellikan A, et al. Routine Pathological Analysis of Appendicectomy Specimens — Is it Justified? Acta Chir Belg. 2007;107:529-30.
8. Akbulut S, Tas M, Sogutcu N, Arikanoglu Z, Basbug M, Utku A, et al. Unusual histopathological findings in appendectomy specimens: A retrospective analysis and literature review. World J Gastroenterol. 2011;17:1961-70.
9. Matthyssens LE, Ziol M, Barrat C, Champault GG. Routine surgical pathology in general surgery. Br J Surg. 2006;93:362–8.
10. Gorter RR, van Amstel P, van der Lee JH, van der Vorn P, Bakx R, Heij HA. Unexpected findings after surgery for suspected appendicitis rarely change treatment in pediatric patients; Results from a cohort study. J Pediatr Surg. 2017;52:1269–72.
11. Ma KW, Chia NH, Yeung HW, Cheung MT. If not appendicitis, then what else can it be? A retrospective review of 1492 appendectomies. Hong Kong Med J. 2010;16:12-7.