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Appendiceal neoplasms: Evaluation of 4761 appendectomy specimens

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Abstract

Acute appendicitis is the most diagnosed intraabdominal pathology in emergency surgery meanwhile appendiceal neoplasms are infrequent and mostly detected in post-operative pathological work-up. In this study, we aimed to identify the incidence of appendiceal neoplasms and histopathological distribution of appendectomy specimens of our patients operated with the diagnosis of acute appendicitis. Between January 2010 and December 2020 postoperative results of patients who were operated with the diagnosis of acute appendicitis in a tertiary hospital were evaluated. Appendiceal neoplasms and subtypes of neoplasms according to pathology specimens are noted and long-term results of patients diagnosed with malignancy are given. 4761 patients operated for acute appendicitis while 55 (1.1%) of them had neoplasms on postoperative pathological evaluation. Eighteen out of 55 patients (32.7%) there were neuroendocrine tumor and in 36 patients there were mucinous lesions with different grades. Low-grade appendiceal mucinous neoplasms were the most common mucinous lesions. No statistically difference in terms of age and sex between group1 (patients who had appendicitis) and group 2 (patients who had neoplasm). Acute appendicitis is an emergent situation where the routine histopathological examination of specimens should be carefully performed to rule out malignancy.

Keywords: Acute appendicitis, emergency, pathology, neoplasm

Introduction

Acute appendicitis is most commonly diagnosed intraabdominal pathology in emergency surgery. Overall lifetime risk of having disease of men and women are 8,6% and 6.9 % respectively [1]. There were plenty of scoring systems that have been used to aid in the early diagnosis of acute appendicitis. These systems are valuable and try to discriminate acute appendicitis and nonspecific abdominal pain. Alvarado is one of the most famous scoring system, which is first developed in 1986 including following criteria: right lower quadrant tenderness, leukocytosis, migration of pain, fever, left shift in complete blood count, nausea/vomiting and vomiting [2]. In addition appendicitis inflammatory response

(AIR) scoring system adds new criteria which are CRP levels and grading of right lower quadrant pain and can be more specific to diagnose acute appendicitis [3]. The mechanism of development of appendicitis still not fully understood. Obstruction of the lumen due to fecalith or lymphoid tissue hypertrophy followed by inflammation resulting in appendicitis is the most accepted theory. The etiology of luminal occlusion can differ with age; while lymphoid follicular hyperplasia is the main cause in young people, fibrosis, fecaliths or neoplasia-related causes increase with age [4]. Malignancies of the appendix are mostly diagnosed by examining the post-operative specimen.

This study aimed to present the frequency of appendiceal malignancies encountered in pathology specimens of the patients who operated as acute appendicitis and the long-term results of patients diagnosed with malignancy.

Materials and Methods

Medical records of patients, who were performed appendectomy

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with a diagnosis of acute appendicitis in a tertiary hospital between January 2010 and December 2020, were collected with the help of the electronic records of the hospital. Indication of acute appendicitis was decided by the general surgeon who was on duty for patients who had signs of acute appendicitis with the help of ultrasonography and computed tomography whether indicated. Basic criteria of Alvarado and AIR scoring system used but there were no data given for each patients' score in this article. Patients were divided into two group; group 1 consist of patient who had appendicitis, group 2 consist of patients who had neoplasms on their pathological evaluation. Figure 1 indicates the flowchart of the study. Patients who were under the age of 18, and those to whom appendectomy was performed other than emergency like as a part of colorectal surgery or gynecological surgery were excluded from the study. Also, patients who had advanced liver disease, additional organ malignancies and missing data were excluded from the study. The study was approved by University of Health Sciences Antalya Education and Research Hospital's ethical committee with 4/21 registration number.

Statistical Analysis

All statistical analysis was carried out using JMP version 15.1 (SAS Institute Inc., Cary, NC, 1989-2019). Normality analysis of the data was tested using Shapiro-Wilk test. As the continuous variables were not normally distributed; descriptive statistics are shown as median $\pm$ interquartile range (IQR). Categorical variables are displayed using numbers (n) and percentages (%). Mann Whitney U test was performed in the comparison of age, length of hospital stay (days). A p-value <0.05 was accepted as statistically significant.

Results

Between January 2010 and December 2020, 4761 patients who underwent appendectomy with the diagnosis of acute appendicitis were included in the study. Median age of the patients was 32 (24-42), 1888 of them were female and 2873 were male. Laparoscopic appendectomy is routinely performed in 37.1 % of the patients while remaining were operated with conventional open surgical technic. The other demographic data of the patients are shown in Table 1. While 83.5% of 4761 patients were diagnosed with acute appendicitis on their pathology reports, 16.5% of them reported appendix vermiformis or lymphoid hyperplasia that can be called negative appendectomy. An abnormal pathology in the appendix was reported in 55 (1.1%) cases. Eighteen (32.7%) out of 55 patients had neuroendocrine tumors and 37 (67.3%) patients had mucinous lesions with different grades. Low-grade appendiceal mucinous neoplasms were the most common mucinous lesion (n=17). Detailed demographic data of patients with atypical pathology are shown in Table 3. In table 4 shows the comparison the data of patients who had appendiceal neoplasms. Group 1 consists of 4706 patients whether there were 55 patients in group 2. There were no difference between groups in terms of age and sex. But there were statistically significance in surgery type and hospital stay. Laparoscopic appendectomy is more likely to be performed in patients who had appendicitis (group1), whether in group 2 conventional approach is more frequently performed (p=0.001). In terms of hospital stay; patients who had appendiceal neoplasms tend to be stay more at hospital (p<0.001).

Table 1. Demographic properties of patients, n= 4761

Age, median (IQR)	32 (24-42)
Sex, n (%)	
Female	1888 (39.7)
Male	2873 (60.3)
Surgery type, n (%)	
Conventional	2996 (62.9)
Laparoscopic	1765 (37.1)
Length of hospital stay, days, median (IQR)	1 (1-2)
Number appendiceal neoplasms	55 (1.1%)

IQR: interquartile range

Table 2. Demographic data of patients with an appendiceal neoplasm, n=55

Age, median (IQR)	32 (24-43)
Sex, n (%)	
Female	21 (38.1)
Male	34 (61.8)
Surgery type, n (%)	
Conventional	46 (83.6)
Laparoscopic	9 (16.3)
Length of hospital stay, days, median (IQR)	1 (1-3)

IQR: interquartile range

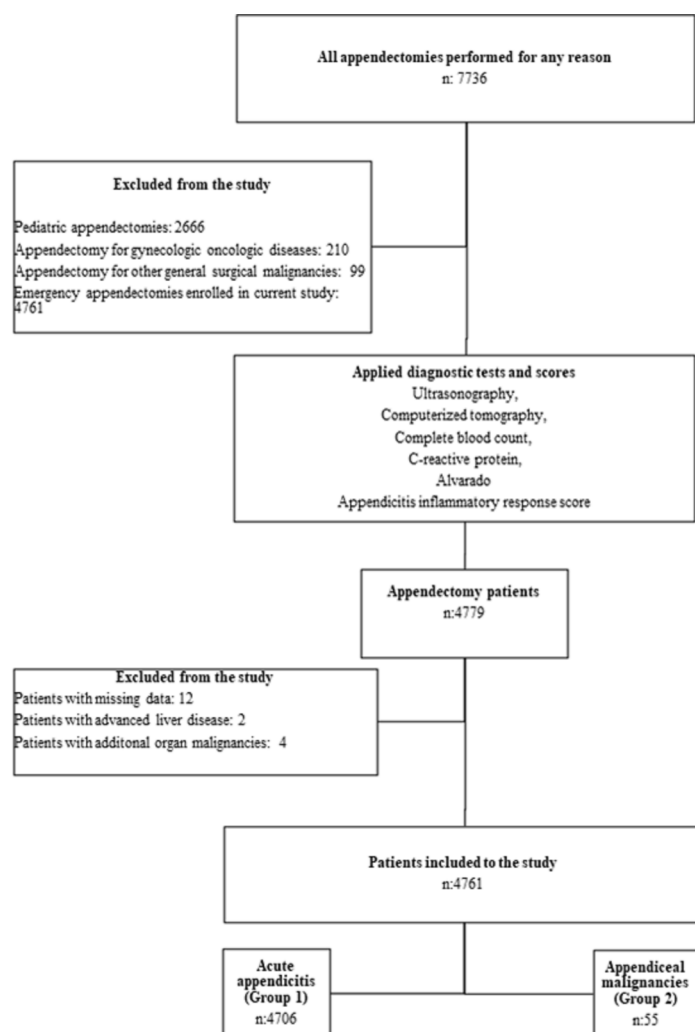


Figure 1. Flowchart of the patient selection enrolled in current study

Table 3. Distribution of appendiceal neoplasm according to pathological findings (n=55)

	n (%)	Sex (F/M), (n)	Age, median (IQR)	Length of hospital stay, days, median (IQR)
Mucinous lesions	37 (66.6)	21/16	22 (20-34)	2 (1-4)
Mucocele	5 (7.4)	1/4	40 (19.5-51.5)	2 (1-5)
Adenoma	11 (20.3)	7/4	35 (21-43)	2 (1-4)
LAMN	16 (29.6)	6/10	27.5 (20.5-39.75)	2 (1.25-4.5)
HAMN	2 (3.7)	1/1	38 (21-52)	7.5 (3-12)
Musinous adenocarcinoma	3 (5.5)	1/2	38 (21-52)	1 (1-2)
Neuroendocrine tumour	18 (33.3)	5/13	33.5 (28.75-48.25)	2 (1-2.25)

LAMN: low grade mucinous neoplasia, HAMN: high grade mucinous neoplasia IQR: interquartile range

Table 4. Comparison of groups

	Acute Appendicitis, n=4706	Appendiceal neoplasm, n=55	p value
Age, median (IQR)**	32 (24-42)	32 (24-43)	0.91
Sex, n (%)			0.82
Female	1867 (39.67)	21 (38.18)	
Male	2839 (59.63)	34 (61.82)	
Surgery type, n (%)			0.001
Laparoscopic	1756 (37.31)	9 (16.36)	
Conventional	2950 (62.69)	46 (83.64)	
Hospital stay, days, median (IQR)**	1 (1-2)	2 (1-3)	<0.001

IQR: interquartile range, ** Mann Whitney U test used

Discussion

Acute appendicitis is the most common condition in surgical practice and causes acute abdomen. Although there are publications suggesting non-operative follow-up in selected cases, the exact treatment is surgery [5,6]. Obliteration of the appendix lumen results in inflammation, gangrenous change, and perforation. This obliteration is mostly caused by fecaloma, lymphoid hyperplasia, and fibrous obliteration, but in some cases appendiceal neoplasia may also be encountered [7–9].

Acute appendicitis is more commonly observed in men than in women [10,11]. In our study, the male to female ratio was 1.52. While the average age of appendectomy with the diagnosis of acute appendicitis was 30-40, the median age was found to be 32 in our study. Causes such as renal colic, mesenteric lymphadenitis, and gynecological pathologies are usually mixed with acute appendicitis, and it is understood by pathology reports that the appendix is normal in 15-20% of patients [12–14]. In our series, 16.5% of the patients were found to have lymphoid hyperplasia and appendix vermiformis.

The development of acute appendicitis secondary to lumen obliteration may sometimes be caused by tumoral lesions of the appendix. The most common of these are appendiceal neuroendocrine tumors, mucinous neoplasms [15,16].

Neuroendocrine tumors are seen primarily in the gastrointestinal system and also in the bronchopulmonary system. They show slow

progression. In some rare cases neuroendocrine carcinoma has also been reported in the breast tissue. The incidence of neuroendocrine tumors in the appendix is on average 0.5% [17–19]. In our study, this rate was found to be 0.4%. It is generally not possible to detect an appendiceal neuroendocrine tumor with preoperative imaging methods. Frequently the diagnosis is made after the pathological evaluation. A secondary surgery is required whether the primary tumor is larger than 2 cm in diameter, tumoral spread in the appendix mesentery, and a positive surgical margin at the base of the appendix. In these cases, a right hemicolectomy is performed [20,21]. We have performed right hemicolectomy for one patient out of the 18 patients diagnosed with neuroendocrine tumor, since the tumor was larger than 2 cm and its continuity was detected in the root of the appendix. This patient is in the 54th month of follow-up and he survives without any sign of recurrence.

Mucinous lesions are frequently encountered among atypical pathologies of the appendix. These are examined in two categories as neoplastic and non-neoplastic lesions. Non-neoplastic ones are classified as mucocele, neoplastic ones as serrated polyp, hyperplastic polyp, low-grade mucinous neoplasm (LAMN), high-grade mucinous neoplasm (HAMN), and mucinous adenocarcinoma. Although neoplastic mucinous neoplasms are frequently seen after the age of 50, they are encountered in 0.2%-1.4% of appendectomy cases [22–24]. While the mean age was 32 in our series, the incidence among atypical pathologies was 66%. Mucinous lesions were found in 0.75% of patients who underwent appendectomy for acute appendicitis (Table3).

In our study we have observed that patients who had appendiceal neoplasm due to pathology results are frequently operated by conventional way ($p=0.001$) and more likely to be discharged late ($p<0.001$).

Conclusion

Routine histopathological examination of the specimen obtained from patients who underwent appendectomy for acute appendicitis is important. Pathological examination may be of vital importance in terms of early detection of possible malignancies and planning the continuation of treatment.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

The study was carried out with the permission of University of Health Sciences Antalya Education and Research Hospital's Ethics Committee (Decision Number: 4/21).

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