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Has laparoscopic surgery reduced negative appendectomy rates?

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ABSTRACT

Introduction: Negative appendectomies can still be performed despite improvements in imaging methods. As a result of advances in minimally invasive surgery, laparoscopic appendectomy rates have increased in the treatment of acute appendicitis. The aim of this study was to investigate the effect of laparoscopic surgery on negative appendectomy rates.

Materials and Methods: Patients who underwent appendectomy for acute appendicitis between December 2016 and December 2018 were retrospectively reviewed. A total of 293 patients were involved in the study. The patients were divided into two groups: open appendectomy and laparoscopic appendectomy. The demographic characteristics and histopathological diagnosis of the patients were recorded. Differences in patients with histopathological diagnoses, except for acute appendicitis, were analyzed.

Results: There were 119 cases in the laparoscopic appendectomy group and 174 cases in the open appendectomy group. The mean age was 35.82 (± 16.48) years. One hundred seventy-six of the cases were male and 117 were female. There was no statistically significant difference between the two groups in terms of demographic characteristics. The same number of negative appendectomy cases was found in both groups. The result was also statistically insignificant.

Conclusion: This study showed that laparoscopic appendectomy did not reduce the negative appendectomy rates. Despite the advances in imaging methods, such as ultrasound and computed tomography, and the advantages of laparoscopy in abdominal exploration, the rates of negative appendectomy are still considerable. Despite all technological developments, anamnesis and physical examination remain important in the diagnosis of acute appendicitis.

Keywords: Acute appendicitis; appendectomy; histopathology; negative appendectomy.

Introduction

Acute Appendicitis is the most common disease of the appendix. Anamnesis and physical examination are very important for the diagnosis.[1,2] All the patients were diagnosed with acute appendicitis as a result of physical examination and laboratory and radiological evaluations. Ultrasonography and/or Computed Tomography (CT) help surgeons in confirming the diagnosis. Although there are publications on conservative approach with antibiotic therapy, the treatment of acute appendicitis is still sur-

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gical. Despite all the developments in imaging methods, negative appendectomies are still performed. Negative appendectomy is the resection of a normal appendix. In the literature, negative appendectomy rates are reported to be between 2% and 30%.[3] As a result, patients are exposed to unnecessary surgical interventions, and face the risk of morbidity and mortality, which might occur afterwards.[4] As a result of the developments in minimally invasive surgery, laparoscopic appendectomy rates are increasing in the treatment of acute appendicitis. Laparoscopic surgery offers several postoperative advantages like early recovery and less pain, as well as the possibility to perform better exploration during the surgery and to examine all parts of the abdomen.[5] In this study, we aimed to investigate the effects of laparoscopic surgery on negative appendectomy rates.

Materials and Methods

Patients who underwent appendectomy for acute appendicitis between December 2016 and December 2018 were reviewed retrospectively. A total of 293 patients were involved in the study. The patients were divided into two groups as open appendectomy and laparoscopic appendectomy. The demographic characteristics and histopathological diagnosis of the patients were recorded. Difference in patients with histopathological diagnosis, except for acute appendicitis, was analyzed. Ethics committee approval and informant consent were not obtained due to the retrospective design of the study.

Statistical Analysis

Statistical analysis was performed by using the SPSS Statistics software package, version 20 (IBM Corp. in Armonk NY). Descriptive data were presented as frequencies (n) and percentages (%) for categorical variables and as mean with standard deviation or median with (min-max range). for non-normal distributed numerical variables. To evaluate the significant

differences between groups, chi square and fisher's exact test were used. Those with $p<0.05$ were considered statistically significant.

Results

There were 119 cases in the laparoscopic appendectomy group and 174 cases in the open appendectomy group. The mean age was 35.82±16.48. One hundred seventy-six of the cases were male and one hundred seventeen were female. There was no statistically significant difference between the two groups in terms of demographic characteristics ($p=0.579$). The same number of negative appendectomy cases was found in both groups. The result was also statistically insignificant (Table 1).

When the histopathological results were examined, 0.6% were found to be normal appendicitis and two results were non-appendicitis pathologies (e.g. neuroendocrine tumor and mucocele). The pathology was determined as neuroendocrine tumor in one patient, mucocele was determined in one patient (Table 2). All the patients who had malignant tumors were those who were diagnosed with acute appendicitis based on the results of physical examination, laboratory and imaging methods. There was no symptom suggestive of malignancy. The patient who had

Table 1. Negative features of appendectomy specimens

Count Total % Column % Row %	Open Apendectomy	Lap Apendectomy	Total
Pathology -	7	7	14
	2.39	2.39	4.78
	4.02	5.88	
	50.00	50.00	
Pathology +	167	112	279
	57.00	38.23	95.22
	95.98	94.12	
	59.86	40.14	
Gender			
Female	62	55	117
Male	112	64	176
Total	174	119	293
	59.39	40.61	

Table 2. Histopathological findings in appendectomy specimens

Specimens	n	%
Different Types of Acute Appendicitis (e.g. necrotizan, eosinophilic, phlegmon etc.)	273	94.46
Mucoceles	1	0.34
Neuroendocrine tumor	1	0.34
Normal appendix	14	4.84
Total	289	100

neuroendocrine tumor smaller than 1 cm in diameter, no poor prognostic features and the patient who had mucocele were followed up conservatively. All the patients were assessed every 3 months for the first year after surgery. The physical examination results were evaluated with laboratory and imaging methods. No pathologies were detected in the follow-up period.

Discussion

Acute Appendicitis is the most common disease of the appendix. For this reason, appendectomy is one of the most common emergency surgical procedures.[1,3,6] Its incidence is higher in children and young adults. The lifelong prevalence is 7-8%.[1,2,7,8] The most common cause in adults is the luminal obstruction by a fecalith. In children, on the other hand, the most common cause is the lymphoid hyperplasia in the submucosa. After the luminal obstruction, the intraluminal pressure increases, and this condition leads to occlusion of lymphatic and venous circulation. If this persists, mucosal edema, ischemia, an invasive infection, and perforation may develop. Anamnesis and physical examination are very important in the diagnosis. Full blood count, urinalysis, and imaging methods like Ultrasonography and Computed Tomography help surgeons in confirming the diagnosis. With easy access and application, especially Ultrasonography provides an advantage in clinical practice in the diagnosis of acute appendicitis. Computed Tomography is more sensitive in the diagnosis of acute appendicitis compared to Ultrasonography.[6] However, there are also several disadvantages like not being available in all healthcare centers, exposure to radiation, and inability to interpret CT scans correctly. Despite all the developments in imaging methods, negative appendectomy can still be performed. Patients are exposed to unnecessary surgical interventions, and face the risk of morbidity and mortality, which might occur afterwards.

Abdominal pain, anorexia, and nausea-vomiting are the most common symptoms of acute appendicitis.[3,9] In this study, the most common complaints of the patients admitting to the Emergency Department were abdominal pain. In this respect, gastroenteritis, mesenteric lymphadenitis, Meckel Diverticulitis, urological diseases, pelvic inflammatory disease, and gynecological diseases like ovarian cyst rupture, and ovarian torsion should kept in mind in the differential diagnosis of acute appendicitis. Mohebbi et al. recommended that the patient be kept under observation for 6-10 hours if the initial clinical condition of the patient does not require urgent surgical requirement. This could reduce unnecessary Laparotomy rates.[3]

Although there have been recent publications on the conservative approach with antibiotics in acute appendicitis treatment in the literature, the primary acute appendicitis treatment is still appendectomy. As a result of the developments in minimally invasive surgery, laparoscopic appendectomy rates are increasing in acute appendicitis treatment. Laparoscopic surgery offers several postoperative advantages like early recovery and less pain, as well as the possibility to perform better exploration during the surgery and to examine all parts of the abdomen.[10] The importance of laparoscopy is great also in terms of correlating the diagnosis before the surgery. However, in addition to all these aspects, as a result of histopathological examination of the appendix, which is seen completely normal in the exploration during the surgery, it can be diagnosed with fibrosis, lumen obliteration, appendix tumor, or parasitic infection.[5,11] Charfi et al.[5] reported that many surgeons used appendectomy to normal-looking appendixes for these reasons. In the present study, based on the surgery data recorded during surgeries, it was observed that no appendix was detected in normal appearance during explorations.

Flum et al. reported that, the negative appendectomy rate was 15.3% in their study. This rate was 4.84% in our study. The results were similar in terms of demographic characteristics when compared with the negative appendectomy cases and other cases. It was reported that women under 6 years of age and over 60 years of age have more negative appendectomy rates. It was also reported in several previous studies that negative appendectomy has many negative consequences like morbidity, mortality, longer hospital durations, and more costs. It has been concluded that all these outcomes must be considered in appendicitis management because of significant clinical and financial results in patients operated with the prediagnosis of acute appendicitis and undergoing negative appendectomy.[4]

It is reported in the literature that negative appendectomy rates are higher in women in general.[3,4,12] This is considered to be because of similar findings in gynecological diseases.[3] The negative appendectomy rates were equal between the female and male gender in our study.

Jones et al.[13] conducted a study with 389 appendicitis patients, and reported that the rates of negative appendectomy decreased by 2% as the frequency of Computed tomography use increased. In a similar study, McGory et al.

reported that the use of Computed tomography was associated with lower negative appendectomy rates for women in generally, especially at <5 and > 45 years of age categories. The use of computed tomography in men was not effective because negative appendectomy rates were similar in all age categories. As a result, computed tomography use was reported to be associated with lower negative appendectomy rates depending on the age and gender of patients.[14] Applegate et al. reported that, the diagnosis of acute appendicitis was more difficult in the pediatric age group. They also reported that patients who were operated without imaging had higher negative appendectomy rates than patients who were operated after being diagnosed with radiological images.[15] Singh et al. reported that negative appendectomy rates were higher in the appendectomies during the night hours and at weekends. They also noted that this result was associated with the difficulties in reaching diagnostic methods and experienced staff.[16] Despite all these results, there are several publications in the literature reporting that the frequency of negative appendectomy has not changed with the development of computed tomography, ultrasonography and laparoscopy in decreasing the unnecessary operation rates.[17-19] The acceptable negative appendectomy rate is 20% in the literature.[6,12,20]

Our study had some important limitations. The retrospective design of the study with a limited number of patients from a single unit that, in turn, led to certain limitations in its design.

Conclusion

Despite the developments in imaging methods like ultrasonography and computed tomography, and the advantages of laparoscopy in abdominal exploration, negative appendectomy rates are still considerable. According to the results of this study, it was shown that laparoscopic appendectomy did not reduce negative appendectomy rates. However, randomized and controlled trials are needed for confirm the results of this study.

As a conclusion, anamnesis and physical examination are still important in the diagnosis of acute appendicitis, despite all the technological developments in the diagnosis and treatment methods.

Disclosures

Ethichs Committee Approval: Retrospective study.

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Conflict of Interest: None declared.

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