



# Is Laparoscopy Superior Than Open Surgery in Finding Unexpected Pathologies in Negative Appendectomies?

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## ÖZET

*Laparoskopi negatif apendektomilerde beklenmeyen bulguları saptamada açık cerrahiye göre üstün müdür?*

**Amaç:** Laparoskopik apendektomilerin avantaj ve dezavantajları halen araştırılmaktadır. Bu çalışmanın amacı negatif apendektomilerde alternatif tanı açısından açık cerrahi ile laparoskopinin karşılaştırılmasıdır.

**Gereç ve Yöntem:** Ocak 2010 ile Nisan 2014 tarihleri arasında, tek merkezde açık apendektomi uygulanan 397 hasta ile Nisan 2014 ile Aralık 2014 tarihleri arasında aynı merkezde yapılan laparoskopik apendektomiler çalışmaya dahil edildi. Ortalama yaş, cinsiyet dağılımı, preoperatif bulgular (Alvarado skorları ve ultrasonografi bulguları), negatif apendektomi oranları ve negatif apendektomilerde saptanan alternatif tanıları karşılaştırıldı.

**Bulgular:** Hastaların demografik özellikleri, preoperatif bulguları ve negatif apendektomi oranları laparoskopik ve açık cerrahi gruplarında benzerdi ( $p>0.05$ ) ancak negatif apendektomilerde saptanan alternatif tanı oranları laparoskopik grupta daha yüksekti (%40.0'a kıyasla %19.6,  $p<0.05$ ).

**Sonuç:** Laparoskopi negatif apendektomi vakalarında alternatif tanının ortaya konulmasında ilave bir tanı aracıdır.

**Anahtar kelimeler:** Açık apendektomi, laparoskopik apendektomi, negatif apendektomi, alternatif tanı

## ABSTRACT

*Is laparoscopy superior than open surgery in finding unexpected pathologies in negative appendectomies?*

**Objective:** Advantages and disadvantages of laparoscopy in appendectomy is still being investigated. The aim of this study is to investigate open and laparoscopic appendectomies in terms of alternative diagnosis in negative appendectomies.

**Material and Methods:** A total of 397 patients who underwent open appendectomy between January 2010-April 2014 and 120 patients who underwent laparoscopic surgery between April 2014-December 2014 in a single institution were included in the study. Average age and gender distribution, preoperative findings (average Alvarado scores and ultrasonographic findings), rate of negative appendectomies and alternative diagnoses were compared.

**Results:** Patient demographics, preoperative findings and rate of negative appendectomies were all similar in laparoscopic and open groups but the rate of the alternative diagnoses in negative appendectomies in laparoscopic group was significantly greater than in open group.

**Conclusion:** Laparoscopy is an additional diagnostic tool to diagnose alternative pathologic findings in negative appendectomies.

**Key words:** Open appendectomy, laparoscopic appendectomy, negative appendectomy, alternative diagnosis

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## INTRODUCTION

Laparoscopic appendectomy (LA) has become one of the most widely performed laparoscopic procedures

worldwide since Semm has described the first LA in 1983 (1). Many studies have been conducted to compare the postoperative outcomes in terms of length of hospital stay, operating time, postoperative morbidity and cost. It has been reported that LA has the advantages of fewer wound infections, less pain and faster recovery, especially in obese and elderly patients while resulted in more operating time and hospital costs (2-5). Other than these advantages, laparoscopic approach offers an additional diagnostic tool at the time of surgery (6). The aim of this study is to compare retrospectively

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**Table 1:** Patient demographics

Characteristics	Laparoscopic group*	Open group	p
Total group	120	397	
Male gender	63 (52.5%)	202 (50.9%)	0.75
Age, years, mean $\pm$ SD	37.72 $\pm$ 1.40	37.67 $\pm$ 0.89	0.244

SD standart deviation

\*The laparoscopic group includes converted procedures

**Table 2:** Preoperative evaluations, histopathological data and accuracy of ultrasonography

	Laparoscopic group	Open group	p
Alvarado score	7.56 $\pm$ 0.10	7.72 $\pm$ 0.05	0.19
Preoperative USG finding (+)	94 (78.3%)	315 (79.3%)	0.81
Appendicitis (+)	90 (75.0%)	305 (76.8%)	0.20
True positivity of USG	78/94 (83.0%)	278/315 (88.3%)	0.45
False negativity of USG	13/26 (50.0%)	33/82 (40.2%)	

**Table 3:** Unexpected findings in negative appendectomies

	Laparoscopic group	Open group	p
Unexpected findings (+)	12/30 (40%)	18/90 (19.6%)	0.024
Unexpected findings in men	3/10 (30%)	1/20 (5%)	0.058
Unexpected findings in women <50	8/16 (50%)	16/67 (23.9%)	0.038
Unexpected findings in women $\geq$ 50	1/6 (16.6%)	1/5 (20%)	0.887

laparoscopic and open exploration in terms of alternative diagnosis in negative appendectomies.

## MATERIAL AND METHODS

The study protocol was approved by the local ethical committee. Patients were identified on the basis of the International of Diseases, procedure coding system (codes 47.01, 47.09) from our hospital records. A total of 517 consecutive patients aged  $\geq$ 18 years underwent an appendectomy for acute appendicitis between January 2010 and December 2014 at our institution. Open surgery was performed in all patients between January 2010 and April 2014 and since April 2014 all appendectomies were started routinely by laparoscopic approach. Patients who underwent incidental appendectomies and interval appendectomies were excluded from analysis.

All patients were examined clinically and by ultrasonography preoperatively. Patients were included either in laparoscopic or in open group depending on the type of surgery performed. Since the aim of the study is to compare laparoscopic and open exploration in terms of alternative diagnosis, patients in whom the operation was started laparoscopically but then converted were included in laparoscopic group. Appendectomy was performed in all patients irrespective of peroperative findings including alternative diagnosis.

Basic patient demographics (age, gender), Alvarado scores, ultrasonographic and histological findings, unexpected findings and diagnosis during surgery were collected. Open appendectomy (OA) was performed either via the McBurney incision or via a right paramedian infraumbilical laparotomy. Laparoscopic appendectomy was performed using the three-trocar technique (one 10 mm subumbilical port, one 10 mm suprapubic trocar and one 5 mm trocar in the left lower quadrant).

Findings of the two groups were compared by  $\chi^2$  test. A p value of <0.05 was considered statistically significant. Statistical analysis was performed by SPSS software, version 17.0 (SPSS, Chicago, IL, USA).

## RESULTS

Of the 517 patients analyzed during the study period, 120 underwent laparoscopic exploration including 12 converted patients and 397 patients open exploration. There was no significant difference with respect to age and gender distribution (Table 1). The average Alvarado scores, the rate of positive findings on ultrasonography (USG), positive appendicitis rates and the accuracy rates of ultrasonography which were similar in both laparoscopic and open groups are summarized in Table 2. The percentages of the overall unexpected pathologies and the percentage of the unexpected pathologies

**Table 4:** List of the unexpected findings

Laparoscopic group	Open group
<i>Gynecological pathologies</i>	<i>Gynecological pathologies</i>
Cyst of right ovary (2)	Cyst of right ovary (7)
Corpus hemorrhagicum (2)	Corpus hemorrhagicum (2)
Right endosalpingiosis	Ruptured cyst of right ovary (2)
Ovarian torsion	Endometriosis (2)
Right salpingitis	Right Salpingitis
Right adnexial adhesion	Ovarian endometrioma
Tubaovarian abscess	Serous tubal carcinoma
<i>Non-gynecological pathologies</i>	<i>Non-gynecological pathologies</i>
Omental cyst	Meckel's diverticulitis (2)
Inflamed epiploic appendices	
Omental infarction	

The number of the patients with the same diagnosis is expressed in paranthesis

among women under 50 years old in the laparoscopic exploration group were significantly greater than in the open group (Table 3). The unexpected findings are presented in Table 4.

## DISCUSSION

In the present study, we could show that laparoscopic exploration offers the advantage of finding alternative diagnosis in negative appendectomies. Laparoscopic appendectomy has evolved as the standard procedure in our university hospital since April 2014 and it is standard to perform appendectomy in spite of negative exploratory findings in our clinic. Therefore we had the opportunity of comparing the data of 517 consecutive patients, of whom 120 underwent laparoscopic exploration including the converted procedures.

Patient demographics, the Alvarado scores, the positive predictive values of preoperative USG and negative appendectomy rates in open and laparoscopic group were all similar. However, the percentage of the unexpected pathologies in negative appendectomies in the laparoscopic group was significantly greater than in the open group.

Barrat et al. have suggested that laparoscopy significantly reduces the rate of resection of histologically normal appendices by identifying an alternative diagnosis (7). Van den Broek have reported that by leaving 109 healthy-looking appendices in place in 377 patients who underwent diagnostic laparoscopy, negative appendectomy rate was reduced from 25% to 14% in surgically managed patients (8). However, Barrat et al. have also reported in another study that surgeons

may not differentiate between a healthy and a pathological appendix and the risk of false-positive and false-negative appendectomy rate is approximately 10% (9). They proposed that the diagnostic difficulties usually occur in the initial phase of the disease with acute mucosal involvement in morphologically normal appendix. In our clinic, we perform appendectomy in all patients who underwent surgery with the initial diagnosis of appendicitis, including in patients with alternative perioperative diagnosis. With a different point of view, Ekeh et al. hypothesized that laparoscopy may increase the enthusiasm to operate the patients with right lower quadrant pain, thus increase the negative appendectomy rate (10). They found that the negative appendectomy rate for the LA group was 23.3% compared with 14.0% for the OA group. In our study, the preoperative findings in LA and OA groups including Alvarado scores and findings on USG were similar as well as the negative appendectomy rates (25.0% vs 23.2%, respectively). Ekeh et al. also reported that the rates of alternative diagnoses were 40.5% and 28% in LA and OA groups, respectively but the difference between the groups was not significant. Even if these rates were close to our results (40.0% vs 19.6%), the percentage of the unexpected pathologies in negative appendectomies in the laparoscopic exploration was significantly greater than in the open group in our study. It is worthy of note that in the study of Ekeh et al., groups were not randomized, the average age was significantly greater in OA group and the converted procedures were included in OA group instead of LA group. However, in the present study, we compared laparoscopic exploration and open procedures in similar groups and we included the converted procedures in laparoscopic exploration group.

The difference between laparoscopic and open groups in terms of unexpected pathologies was most remarkable among women under 50 years old. As expected, a gynecologic disorder was most commonly diagnosed in this group of patients except in one who had Meckel's diverticulites. This finding is consistent with study of Larsson et al. (11). They reported that a gynecologic diagnosis was found in 73% after laparoscopy, as compared with 17% after open surgery among the fertile women with a healthy appendix and explained this difference by the more complete vision of the deep pelvis by laparoscopy.

Other than the advantages of fewer wound infections,

less pain and faster recovery, laparoscopy offers an additional diagnostic tool to diagnose alternative pathologic findings and therapeutic options to treat them at the time of laparoscopy. We believe that the diagnosis of non-gynecologic pathologies, omental pathologies in particular, would have probably been missed during open surgery. Laparoscopy seems also to be better in diagnosing gynecologic pathologies in female patients with suspected appendicitis. On the other hand, we have to assume that in the open group some pathologies have been missed since the groups were completely comparable. However, when we checked the hospital records, we could not find any

readmission of the patients but only few who were diagnosed as postoperative fluid collection. We think this could be explained by simply spontaneous regression of the alternate pathologies or postoperative use of antibiotics might have treated the alternative pathologies as well. Even if the choice of the procedure seems not to affect the postoperative clinical course, still laparoscopy is superior than open surgery in finding unexpected pathologies in negative appendectomies.

#### **Disclosures statement:**

No competing financial interests exist.

## **REFERENCES**

1. Semm K. Endoscopic appendectomy. *Endoscopy* 1983; 15: 59-64.
2. Masoomi H, Mills S, Dolich MO, et al. Comparison of outcomes of laparoscopic versus open appendectomy in adults: Data from the Nationwide Inpatient Sample (NIS), 2006-2008. *J Gastrointest Surg* 2011; 15: 2226-2231.
3. Sauerland S, Jaschinski T, Neugebauer EAM. Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database Syst Rev* 2010; 10: CD001546.
4. Woodham BL, Cox MR, Eslick GD. Evidence to support the use of laparoscopic over open appendectomy for obese individuals: a meta-analysis. *Surg Endosc* 2012; 26: 2566-2570.
5. Masoomi H, Mills S, Dolich MO, et al. Does laparoscopic appendectomy impart an advantage over open appendectomy in elderly patients? *World J Surg* 2012; 36: 1534-1539.
6. Partecke LI, von Bernstorff W, Karrasch A, et al. Unexpected findings on laparoscopy for suspected acute appendicitis: a pro for laparoscopic appendectomy as the standard procedure for acute appendicitis. *Langenbecks Arch Surg* 2010; 395: 1069-1076.
7. Barrat C, Champault G, Catheline JM, Rizk N, Ziol M, Guettier C. Does laparoscopy reduce the incidence of useless appendectomies? *Ann Chir* 1998; 52: 965-969.
8. van den Broek WT, Bijnen AB, van Eerten PV, de Ruiter P, Gouma DJ. Selective use of diagnostic laparoscopy in patients with suspected appendicitis. *Surg Endosc* 2000; 14: 938-941.
9. Barrat C, Catheline JM, Rizk N, Champault GG. Does laparoscopy reduce the incidence of unnecessary appendectomies? *Surg Laparosc Endosc* 1999; 9: 27-31.
10. Ekeh AP, Wozniak CJ, Monson B, Crawford J, McCarthy MC. Laparoscopy in the contemporary management of acute appendicitis. *Am J Surg* 2007; 193: 310-313.
11. Larsson PG, Henriksson G, Olsson M, et al. Laparoscopy reduces unnecessary appendectomies and improves diagnosis in fertile women: A randomized study. *Surg Endosc* 2001; 15: 200-202.