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Comparison of laparoscopic and open appendectomy for complicated appendicitis: Retrospective analysis of single centre experiences

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Abstract

Despite all the advances in laparoscopic surgery, it is still controversial whether complicated appendicitis should be treated by laparoscopic or open surgery. In this study, we aimed to compare intraoperative and postoperative outcomes of patients with complicated appendicitis who underwent laparoscopic or open appendectomy. Between March 2018 and March 2022, 151 patients underwent laparoscopic or open appendectomy for complicated appendicitis were analysed retrospectively. Demographic, laboratory data, and postoperative outcomes were examined. The median age of the patients was 46 years (interquartile range: 31-63) and 55% of the patients were male. Laparoscopic appendectomy was performed in 54.3% of the patients. While there was no significant difference observed in hospitalization durations between groups, laparoscopic appendectomy exhibited longer operation times compared to open appendectomy. Furthermore, postoperative follow-ups revealed a higher incidence of severe complications (Clavien-Dindo 3-4) in laparoscopic appendectomy (p=0.037). Subgroup analysis of complications indicated a greater frequency of intra-abdominal abscesses in laparoscopic procedures (p=0.033). Although the benefits of minimally invasive surgeries have been well-established, in cases of complicated appendicitis, we recommend open surgery over laparoscopic surgery to clinicians.

Keywords: Complicated appendicitis, laparoscopic appendectomy, open appendectomy

Introduction

Acute appendicitis (AA) is one of the most common causes of acute abdominal pain that treated with emergency surgical procedures [1]. Although some authors support that appendicitis can be resolved without medical treatment, appendectomy is still gold standard procedure for management of most of types appendicitis especially complicated appendicitis (CA) [2,3]. Since the McBurney's description in 1894, open appendectomy (OA) is an established safe and effective procedure for treating acute appendicitis [4]. However, advances in laparoscopic surgical procedures the incidence of laparoscopic appendectomy (LA) has increased in the past decade [5]. The best type of surgical procedure for complicated is still controversial. LA has some superior benefits to OA such as faster recovery, reduced the rates of surgical site infection, reduced length of hospital stay, shorten the time until oral intake and quicker return the work [6]. Despite these benefits, there are controversial data regarding the use of LA in CA, since LA has been associated with higher rates of post-operative intra-abdominal abscesses [7]. In this retrospective study, we aimed to compare the patients outcomes of patients with CA who underwent LA or OA.

Material and Methods

Patient Selection and Study Design

After obtaining approval from the local ethics committee (İnönü University Clinical Research Ethics Committee, 2024/5863), we conducted a retrospective analysis of 151 patients with CA (perforated, gangrenous or plastron appendicitis) who underwent

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LA or OA at our clinic between March 2018 and March 2022. The patients with complicated appendicitis were categorized into two groups based on the surgical technique employed; LA and open appendectomy OA groups. Various demographic parameters of the patients, including age, gender, body mass index (BMI), American Society of Anaesthesiologists (ASA) score, comorbid conditions, intraoperative findings, histopathological diagnoses, duration between symptom onset and surgery, preoperative radiological assessments, preoperative white blood cell (WBC) count, C-reactive protein (CRP) level, appendix diameter, operation duration, presence of intra-abdominal drain, withdrawal time of the drain, postoperative complications, management of complications, and length of hospital stay were systematically reviewed for each group.

Patient Management

The diagnosis of CA was established based on physical examination findings, as well as laboratory and radiological assessments, including ultrasonography and/or computerized tomography. Patients with incomplete data, absence of CA according to pathological reports, and those who underwent appendectomy for reasons other than CA during the same surgical session were excluded from the study.

Surgical Technique

OA was performed through McBurney, right lower para-median, or subumbilical midline incisions. For LA, pneumoperitoneum was created using a Veres needle in the subumbilical region, maintaining intra-abdominal pressure between 12-14 mmHg throughout the procedure. A 10-mm trocar was inserted subumbilically for camera placement, and two additional trocars were positioned—one 5-mm trocar in the midline just above the pubis and another 10-mm trocar on the left side, symmetrically opposite the McBurney point. The appendicular artery was coagulated using an electro thermal bipolar vessel sealing device. Appendectomy was completed using two handmade endoloops or polymer ligating clips, and the removed appendix was placed in a handmade bag made from a surgical glove for extraction. In patients with abscess or purulent fluid around the appendix, a drain was placed in the surgical region.

Statistical Analysis

The sample size for this study was determined using power analysis with G-Power 3.1 software. A power (1-β) of 0.90 and a confidence level of 95% were considered, resulting in a calculated sample size of 60 participants per group. Therefore, a minimum total sample size of 120 participants was determined for both groups. The normality of the distribution was assessed using the Kolmogrov Smirnov test. Nonparametric tests, specifically the Mann-Whitney U test, were employed as appropriate. Descriptive statistics, including median and interquartile range(IQR), were reported for the variables. Categorical variables were analyzed using chi-square analysis, and the results were presented as frequencies and percentages. Statistical significance was defined as $p<0.05$.

Results

Between March 2018 and March 2022, in 151 patients with CA LA or OA was performed. The median age of patients were 46 years (range: 31-63), with 68 patients (45%) being female. Additionally, in 82 (54.3%) patients LA was performed.

The majority of the patient population were classified as ASA 1; however, 14.6% of patients were categorized as ASA 3. The median BMI of the patients was 29 (24-33) (Table 1).

In patients undergoing surgery for CA, the median age of the group undergoing OA was 54 (34-70), whereas it was 39 (31-59) for those undergoing LA (p=0.017). The majority of cases classified as ASA 1 underwent laparoscopic surgery, while it was observed that ASA 2 and ASA 3 patients underwent OA (p=0.009). Regarding the duration of surgery, the median duration for laparoscopic appendectomies was 65 (55-75) minutes, whereas for open appendectomies, it was 58 (45-80) minutes (p=0.015). Additionally, severe complications such as CD 3-4 were more frequent in laparoscopic appendectomies compared to open appendectomies within the patient population (p=0.037). No statistically significant difference was observed between the groups in terms of total hospitalization duration (p=0.665). Additionally, there were no significant differences between the groups in terms of postoperative complications or laboratory markers that could adversely affect the intraoperative process (Table 2).

In subgroup analyses concerning postoperative complications, the most frequent complication in laparoscopic appendectomies was paralytic ileus (17.1%), while in open appendectomies, it was superficial surgical site infection (SSSI) (8.7%). Additionally, intra-abdominal abscesses were statistically more frequent in laparoscopic appendectomies (p=0.033) (Table 3).

Table 1. Demographic and operative data of the population

Variables		n (%)	Median (IQR)
Gender	Male	83 (55)	
	Female	68 (45)	
Age, year			46 (31-63)
ASA*	ASA1	90 (59.6)	
	ASA2	39 (25.8)	
	ASA3	22 (14.6)	
BMI**, kg/m²			29 (24-33)
Operation Type	Laparoscopic	82 (54.3)	
	Open	69 (45.7)	

*ASA: American Society of Anaesthesiologists, **BMI: body mass index

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Table 2. Analysis of demographic, clinical, and operative data of patients between the groups

Variables		Laparoscopic tech. n (%)	Laparoscopic tech. Median (IQR)	Open tech. n (%)	Open tech. Median (IQR)	p- value
Gender	**Male**	46 (56.1)		37 (53.6)		0.761
	Female	36 (43.9)		32 (46.4)		
Age, year			39 (31-59)		54 (34-70)	**0.017**
ASA*	**ASA1**	58 (70.7)		32 (46.4)		**0.009**
	ASA2	16 (19.5)		23 (33.3)		
	ASA3	8 (9.8)		14 (20.3)		
BMI, kg/m²**			28 (24-33)		31 (24-33)	0.327
Appendix Diameter, mm			10 (8-13)		11 (8-15)	0.192
Arrival time ED*, day**			3 (2-3)		3 (2-4)	0.115
Operation time, hour			65 (55-75)		58 (45-80)	**0.015**
CD**	**1-2**	60 (73.2)		60 (87)		**0.037**
	3-4	22 (26.8)		9 (13)		
Length of stay hospital, day			4 (2-5)		4 (3-5)	0.665

*ASA: American Society of Anaesthesiologists, **.BMI: body mass index, ***.ED: emergency department, ****.CD: Clavien-Dindo

Table 3. Analysis of postoperative complication subgroups

Variables		Laparoscopic tech. n (%)	Open tech. n (%)	p-Value
Complication	**Absence**	57 (69.5)	52 (75.4)	0.085
	AKI*	0 (0)	1 (1.4)	0.424
	ACS**	1 (1.2)	0 (0)	0.274
	AF***	0 (0)	1 (1.4)	0.357
	Paralytic ileus	14 (17.1)	4 (5.8)	0.274
	Intraabdominal abscess	7 (8.5)	2 (2.9)	**0.033**
	Enterocutaneous fistula	0 (0)	1 (1.4)	0.145
	Pneumonia	1 (1.2)	2 (2.9)	0.274
	SSSI****	2 (2.4)	6 (8.7)	0.461

*AKI: acute kidney injury, **ACS: acute coronary syndrome, ***AF: atrial fibrillation, ****SSSI: superficial surgical site infection

Discussion

Despite the well-established benefits of minimal invasive surgeries in terms of pain control, fewer postoperative complications such as surgical site infection, ileus, long hospital stay [8] and improved patient recovery [6,9] our study revealed that in complicated acute appendicitis cases, patients undergoing laparoscopic surgery experienced a higher incidence of severe complications (CD 3-4), with subgroup analyses indicating a statistically significant increase in intra-abdominal abscesses.

The incidence of intra-abdominal abscess in complicated appendicitis, occurring in nearly one out of every four patients, is considered a hindrance for laparoscopic appendectomy [10,11]. Although the incidence of intra-abdominal abscess is high in laparoscopic appendectomies, randomized controlled trials have not shown a significant difference in the occurrence of intra-abdominal abscess between the two techniques [12].

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One possible reason for the high incidence of severe complications, especially intra-abdominal abscesses, in laparoscopic appendectomies may be attributed to inadequate irrigation of interloop intestinal collections due to surgical technique.

Although no significant difference was found between the groups in terms of superficial surgical site infections (SSSI), our study revealed a higher frequency of SSSI in open appendectomies. The lower incidence of SSSI in laparoscopic cases is believed to be attributed to the use of an endobag. Additionally, it has been shown that surgical site infections are less frequent in laparoscopic appendectomies [13]. Therefore, it is believed that hospitalization durations are shorter in laparoscopic appendectomies due to this reason.

Although postoperative paralytic ileus is commonly observed in cases of electrolyte disturbances, prolonged abdominal surgeries, and non-minimally invasive cases, it has also been shown to occur frequently in contaminated cases. However, our study also revealed a higher incidence of paralytic ileus in laparoscopic cases. The most significant reason for this is the peritonitis caused by complicated appendicitis.

It has been demonstrated that laparoscopic appendectomies take longer operation times compared to open appendectomies. Additionally, although the rates of complications requiring invasive procedures are higher in laparoscopic cases, these rates have not been reflected in hospitalization durations.

One of the most significant limitations of the study is its retrospective nature. Additionally, including the prevalence of peritonitis in the planned randomized controlled trials to be conducted in the future will allow for further standardization of the study.

Conclusion

In cases of complicated appendicitis, laparoscopic surgery can be performed based on the suitability of patients and the technical capabilities of the surgeon. However, due to the higher incidence of severe complications requiring invasive procedures (CD 3-4) in laparoscopic appendectomies, especially in populations that may be frail and in cases where surgical experience is inadequate, we recommend clinicians to consider performing open appendectomies.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
After obtaining approval from the local ethics committee (İnönü University Clinical Research Ethics Committee, 2024/5863).

References

1. Findlay M, Kafsi JE, Hammer C, et al. Nonoperative management of appendicitis in adults: a systematic review and meta-analysis of randomized controlled trials. J Am Coll Surg. 2016;223:814-24.e2.
2. Gorter RR, vander Lee JH, Cense HA, et al. Initial antibiotic treatment for acute simple appendicitis in children is safe: short-term results from a multicenter, prospective cohort study. Surgery. 2015;157:916-23.
3. Salminen P, Paajanen H, Rautio T, et al. Antibiotic therapy vs appendectomy for treatment of uncomplicated acute appendicitis: the appac randomized clinical trial. JAMA. 2015;313:2340-8.
4. Seem K. Endoscopic appendectomy. Endoscopy. 1983;15:59-64.
5. Shaikh AH, Tandur AE, Sholapur S, et al. Laparoscopic versus open appendectomy: a prospective comparative study and 4-year experience in a tertiary care hospital. Surg J. 2022;8:e208-14.
6. Yu MC, Feng YJ, Wang W, et al. Is laparoscopic appendectomy feasible for complicated appendicitis? A systematic review and meta-analysis. Int J Surg. 2017;40:187-97.
7. Pokala N, Sadhasivam S, Kiran RP, Parithivel V. Complicated appendicitis is the laparoscopic approach appropriate? A comparative study with the open approach: outcome in community hospital setting. Am Surg. 2007;73:737-41; discussion 741-2.
8. Wu T, Yang Y, Wu Y, et al. Complications after appendectomy in patients with treated appendicitis: results from a retrospective study. Ann Palliat Med. 2021;10:12546-553.
9. Gu Q, Hua Y. Perforated appendicitis treated with laparoscopic appendicectomy or open appendicectomy: a meta-analysis. J Minim Access Surg. 2023;19:348-54.
10. Reid RI, Dobbs BR, Frizelle FA. Risk factors for post-appendicectomy intra-abdominal abscess. Aust N Z J Surg. 1999;69:373-4
11. Barut B, Ceylan C. Preoperative predictor laboratory markers for complicated appendicitis: a retrospective analysis of single center experience. Med Science. 2023;12:695-9.
12. Talha A, El-Haddad H, Ghazal AE, Shehata G. Laparoscopic versus open appendectomy for perforated appendicitis in adults: Randomized clinical trial. Surg Endosc. 2020;34:907-14.
13. Markides G, Subar D, Riyad K. Laparoscopic versus open appendectomy in adults with complicated appendicitis: Systematic review and meta-analysis. World J Surg. 2010;34:2026-40.