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Appendectomy in Patients with Morbid Obesity: Laparoscopic versus Conventional Technique

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Data Collection B

Statistical Analysis C

Data Interpretation D

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Background:

Our aim was to determine the optimum appendectomy technique in patients with morbid obesity by evaluating laparoscopic appendectomy (LA) and open appendectomy (OA) operations performed in these patients.

Material/Methods:

The records of 2179 patients who underwent appendectomy for acute appendicitis between January 2010 and April 2019 were evaluated retrospectively. Patients were excluded for the following: age <18 years; body mass index (BMI) of <40 kg/m²; perforation and/or plastron detected. The remaining 89 patients were included in the study. The patients were divided into 2 groups: the LA group (n=40) and the OA group (n=49). Demographic data, duration of operation, operation-related wound infection status, operation-related intra-abdominal complication status, operation-related nonsurgical complication status, and length of hospital stay were recorded.

Results:

No statistically significant difference was found between the 2 groups in terms of age and sex ($P=0.062$, $P=0.078$, respectively). However, the average BMI value in the LA group was significantly higher than that of the OA group ($P<0.001$). Duration of operation and length of hospital stay were significantly lower in the LA group than in the OA group ($P<0.001$, $P<0.001$, respectively). General complications and wound infection were significantly lower in the LA group than in the OA group ($P=0.012$, $P=0.031$, respectively).


Conclusions:

Although LA did not have a clear advantage over OA in patients with morbid obesity, it should be emphasized that laparoscopic surgery may be preferred due to advantages such as a shorter length of hospital stay and lower risk of wound infection.

MeSH Keywords:

Appendectomy • Appendicitis • Laparoscopy • Obesity, Morbid

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Background

Acute appendicitis is a common cause of acute abdominal pain worldwide, with an overall lifetime incidence of about 100 to 206 per 100 000 person-years in the general population [1]. The open appendectomy (OA) technique, which was first described by McBurney in 1894, was the standard procedure until the 1980s [2]. With the increasing application of laparoscopic appendectomy (LA), which was first performed by the gynecologist Semm, the OA technique has been questioned [3,4]. Although LA has some superior aspects compared with OA, such as lower incidence of wound infections, less postoperative pain, and shorter length of hospital stay, the optimal technique still has not been fully established [5].

Since 1980, the prevalence of obesity in the world has doubled, and is reported to be around 12% [6]. Given that obesity is now a common disease, general surgeons will have to perform appendectomy in patients with obesity with an increasing frequency. However, open operations in the obese patient population have been shown to cause larger wounds, more postoperative pain, and more lung complications than in the normal-weight population [7]. One study showed that, although LA had an advantage in terms of shorter length of hospital stay compared to OA, it had some disadvantages, such as a longer surgery time [8]. Therefore, unlike laparoscopic cholecystectomy for cholecystolithiasis, LA has still not become the criterion standard method in the treatment of acute appendicitis. Considering that the difficulties of abdominal surgery can be even greater in patients with morbid obesity, determining the appropriate appendectomy technique for this patient group becomes even more important.

Our aim in this study was to determine the optimum appendectomy technique in patients with morbid obesity by evaluating LA and OA operations performed in this patient group.

Material and Methods

A retrospective and observational cohort methodology was used in this study. After ethics committee approval was received from the Clinical Research Ethics Committee of our university, the records of 2179 patients who underwent appendectomy for acute appendicitis between January 2010 and April 2019 were retrospectively evaluated. Of these 2179 patients, 723 patients were excluded from the study because they were under 18 years old and 1342 were excluded because they had less than a 40 kg/m² body mass index (BMI). We could not access all the necessary data for 10 of the patients who were morbidly obese and who underwent an appendectomy, and an additional 15 patients with morbid obesity were excluded because of perforation and/or plastron formation. The existence

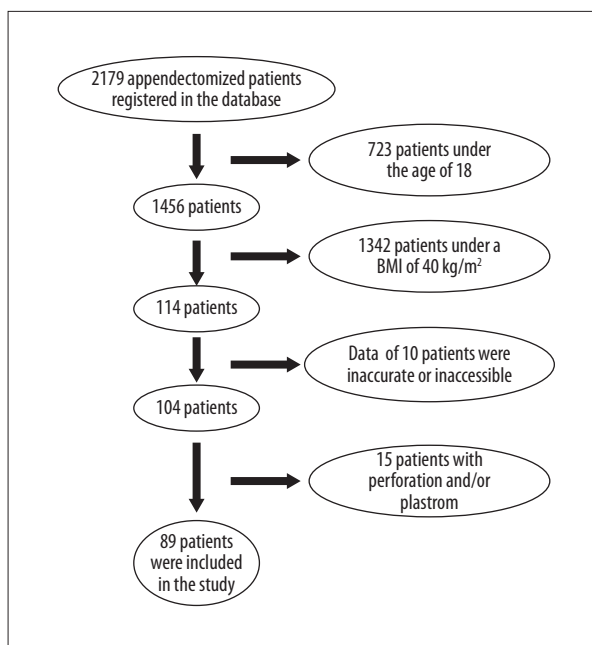


Figure 1. Study flowchart.

of severe inflammation was verified by pathological reports for all of the 15 patients who were excluded. The remaining 89 patients were included in the study. A flowchart of the study population is presented in Figure 1.

The patients were divided into 2 groups: the LA group (40 patients) and the OA group (49 patients). Demographic data, duration of operation, wound infections, intra-abdominal complications, nonsurgical complications, and length of hospital stay were recorded.

OA was performed using the standard procedure via the McBurney incision. The mesoappendix was dissected with monopolar electrocautery. After the appendix was removed, the appendix stump was closed with the Z-suture or purse-string suture technique. In LA, the traditional method of 3 ports (intraumbilical, suprapubic, and left lower quadrant) was used. In only 1 case, a fourth trocar was placed in the right lower quadrant. The mesoappendix was dissected with monopolar electrocautery. The appendix artery was ligated with endoclips. The appendix stump was closed with an extracorporeally prepared endoloop. The appendix was taken out of the abdomen through the suprapubic incision with the help of a retrieval bag. After the appendix was taken out of the abdomen, a wash and/or Jackson-Pratt drain was placed in case of suspicion of intraperitoneal contamination. In both groups, no other surgical procedures were performed in addition to the appendectomy during the operation.

For both procedures, the duration of operation (min) was recorded from the first skin incision until the final skin suture

Table 1. Sociodemographic characteristics and data of comorbidity.

	LA group n=40	OA group n=49	p Value
Age*	34.18±5.80	36.65±6.56	.062
BMI***	44.10±3.06	41.82±1.79	<.001
Gender			
Female (%)	17 (42.5)	30 (61.2)	.078
Male (%)	23 (57.5)	19 (38.8)	
Comorbidity			
Type 2 DM (%)	11 (27.5)	11 (22.4)	.583
HT (%)	8 (20)	14 (28.6)	.351
OSAS (%)	5 (12.5)	3 (6.1)	.295
CAD (%)	1 (2.5)	2 (4.1)	.681

LA – laparoscopic appendectomy; OA – open appendectomy; DM – diabetes mellitus; HT – hypertension; OSAS – obstructive sleep apnea syndrome; CAD – coronary artery disease. * Data are shown as mean±standard deviation; **BMI was given in kg/m².

Table 2. Data of operation time and length of hospital stay and complications.

	LA group	OA group	p Value
Operation time*	52.88±14.31	65.41±15.37	<.001
Length of hospital stay*	2.35±1.76	4.78±2.33	<.001
Complications			
Wound infection (%)	1 (2.5)	8 (16.3)	.031
Intra-abdominal abscess (%)	1 (2.5)	2 (4.1)	.681
Pneumonia (%)	1 (2.5)	4 (8.2)	.248
Total complications (%)	2 (5)	12 (24.5)	.012

LA – laparoscopic appendectomy; OA – open appendectomy. * Data are shown as mean±standard deviation.

was completed. Length of hospital stay was determined as the number of nights spent in the hospital after surgery. Intra-abdominal abscess was defined as a collection diagnosed by ultrasonography (US) or computed tomography (CT), or as aspirating purulent content in aspiration under US guidance.

Statistical analysis

The SPSS 22.0 (Statistical Package for Social Sciences, IBM Inc, Chicago, IL, USA) program was used for statistical analysis of the data. The Kolmogorov-Smirnov test was used to test the distribution of normality. A chi-square test was used to compare the groups related to categorical variables. In the parametric data, the *t* test was used to compare the 2 groups, and the Mann-Whitney U test was used for nonparametric data. A *P* value of less than 0.05 was considered statistically significant.

Results

There were 40 patients in the LA group and 49 patients in the OA group. There was no significant difference between the 2 groups in terms of age and sex. However, the average BMI value in the LA group was statistically significantly higher than that of the OA group. In addition, there was no significant difference in comorbidities between the 2 groups. Sociodemographic characteristics and comorbidity data are shown in Table 1.

In the statistical analysis, it was found that the average duration of operation in the LA group was significantly shorter than that of the OA group. In addition, the average length of hospital stay in the LA group was significantly shorter than that of the OA group. Data on the duration of the operation and the length of hospital stay are provided in Table 2.

None of the patients undergoing LA required conversion to open surgery. In addition, there were fewer complications in the LA group than in the OA group. In the LA group, 1 patient

developed an intra-abdominal abscess and 1 patient developed wound infection and pneumonia, while in the OA group, 6 patients had wound infection, 1 patient had an intra-abdominal abscess, 3 patients had pneumonia, 1 patient had wound infection and intra-abdominal abscess, and 1 patient had pneumonia and wound infection. Data on these cases are shown in Table 2. It should be noted there was no mortality in either group.

Discussion

In this study, the duration of operation in patients undergoing LA was significantly shorter than in those who underwent OA. This result is supported by the findings of Mason et al. [9]. It can be considered that the surgeons who performed the operations in our study were experienced in laparoscopic surgery, which would explain the shorter duration of operation in patients undergoing LA. However, since the number of studies on patients with morbid obesity undergoing appendectomy is very limited, and studies are mostly done on patients with obesity with BMI >30 kg/m², only a small number of studies have been found in the literature that can clarify the effect of surgeon experience on operation duration. In studies on patients with obesity, there is contradictory information regarding the duration of the operation. For example, in a randomized prospective study by Clarke et al., no difference was found between durations in patients undergoing LA and OA. However, the relatively low number of cases in the study limits its contribution on this issue [10]. Corneille et al. reported that in patients with obesity, the duration of operation was significantly shorter in patients who underwent LA than in those who underwent OA [11].

In the present study, we determined that the length of hospital stay was shorter in patients who underwent LA than in patients who underwent OA. Similar results were found in a study of patients with morbid obesity by Varela et al. [12]. It is believed that hospital costs should be lower with shorter lengths of hospital stay; however, because we were unable to access data on cost in the present study, we could not include information that would illuminate this issue.

On the other hand, considering all complications, it was found that complications were significantly lower in patients who underwent LA compared to those who underwent OA. Similar results have been reported in previous studies on patients with morbid obesity [9,12]. However, when the literature is analyzed, different data stand out in studies conducted in patients with obesity. For example, in the study by Masoomi et al., complications in patients with obesity were shown to be less in LA than in OA [13]. In another study involving 7 systematic reviews, similar results were reported [8]. However, in a study by Clarke et al., no difference was found between the 2 groups in

terms of complications [10]. As can be seen, there is no consensus on the general complications and the superiority of either technique in studies on patients with obesity. However, the present study was conducted in the morbidly obese patient class, and previous studies conducted on patients with morbid obesity show that general complications in LA may be lower than in OA. We believe that further work is needed to establish a consensus on this issue.

In our study, it was found that wound infection was higher in patients treated with OA than in patients treated with LA. Considering that obesity is a well-known risk factor for wound infection, it is understandable that the rate of wound infection was low in LA, which is a minimally invasive approach [14]. Similar results were obtained in the study conducted by Varela et al. on patients with morbid obesity [12]. However, given the negative effect of diabetes mellitus on wound infection, the fact that the distribution of diabetes mellitus in the groups was not given in the study by Varela and colleagues may be among the limitations of their study. Since there was no difference between the 2 groups in terms of diabetes mellitus in our present study, we believe our study may have shown the effect of the appendectomy technique on wound infection more objectively than in the study by Varela et al. In addition to studies in patients with morbid obesity, the results of many studies on patients with obesity are in line with the results of our study [11,15]. In fact, it seems that LA has a clear advantage in this regard.

On the other hand, in the present study, similar results were obtained between the 2 groups regarding intra-abdominal abscess. While the results of some studies on patients with obesity are parallel to our study, it has been reported that some patients undergoing LA have more intra-abdominal abscesses while others have fewer [8,11,13]. Also, in our study, there was no difference between the 2 groups regarding pneumonia. In general, our study showed no difference between the 2 groups in terms of intra-abdominal abscess and pneumonia, whereas wound infection was significantly higher in those who underwent OA. We think this may explain why general complications were more common in those who underwent OA.

None of the patients included in our study required conversion from laparoscopic surgery to open surgery. We believe that the surgeons who carried out the operations were experienced in laparoscopic surgery, which may explain this.

In the present study, 15 patients with morbid obesity were excluded because of perforation and/or plastron appendicitis. The reason for this exclusion was to reduce the bias in comparisons between the surgeons. Although no mandatory conversion indications were stated, a complicated case is always managed depending on the surgeon's experience. However,

the conversion and/or complication rate would be affected due to the surgeon's choice. Hence, these patients were excluded to optimize the standardization of this retrospective analysis.

Limitations of our study include the retrospective design and the relatively small sample size. Moreover, the fact that the surgeons performing the operations were experienced in laparoscopic operations in patients with morbid obesity may have influenced the results of our study. The main limitation of this study is the lack of surgery choice determinant. The surgical method is always a surgeon's choice. Although this issue seems like a bias, the results revealed significant outcome differences between open and laparoscopic surgery. In the current minimally invasive surgery era, surgeons mostly choose laparoscopic options for all surgical interventions. On the other hand, conventional open appendectomy is still the method of choice of some surgeons. Our next step will be to conduct a prospective model with the same theme.

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Conclusions

Based on our data, LA and OA procedures have no obvious superiority over each other in patients with morbid obesity. We think that the choice of surgical technique should be based on the clinical conditions and surgeon's experience. Nevertheless, the results of our study showed that minimally invasive surgery has some advantages in the treatment of acute appendicitis, as it does in all surgical procedures. Considering that the length of hospital stay was shorter and the risk of wound infection was lower in the LA group, it should be emphasized that laparoscopic surgery might be the preferred surgical method of appendectomy in patients with obesity.

Conflicts of interest

None.