

Comparison of complications of open and laparoscopic appendectomy

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ABSTRACT

Introduction: Evaluations of laparoscopic appendectomy (LA) and open appendectomy (OA) as surgical treatment for acute appendicitis (AA) have yielded varying results. This assessment of the results observed at a single institution and some of the literature findings is provided as a contribution to the discussion about the superiority of different techniques in different patient groups.

Materials and Methods: The patient charts and electronic data of 1587 patients who underwent an OA or LA procedure between June 2014 and August 2018 were retrospectively reviewed. Patients younger than 18 years of age and patients with any pathology other than AA were excluded from the study. A total of 1423 patients, 877 males (61.6%) and 546 females (38.4%), were included in the study. Patients who underwent OA were classified as Group I (n=771, 54.2%) and patients who underwent LA comprised Group II (n=652, 45.8%).

Results: The mean age of the patients was 32.27 ± 11.85 years, the mean duration of the operation was 59.77 ± 20.24 minutes, the mean length of follow-up was 24.46 ± 13.70 months, and the mean length of hospital stay was 1.61 ± 1.14 days. The mean duration of the procedure was shorter in the OA group (58.8 ± 20.9 minutes) compared with the LA group (60.88 ± 19.38 minutes) ($p=0.002$). The percentage of female patients was higher in the LA group (42.94%) than in the OA group (34.50%) ($p=0.001$). The wound site infection rate was higher in the OA group (9.9%) compared with the LA group (9.05%). The rate of complications requiring hospitalization was higher after OA (3.5%) compared with LA (2.3%), and the rate of complications requiring re-operation was also higher with OA (1.03%) compared with LA (0.3%). However, the difference in all parameters was statistically insignificant.

Conclusion: Both OA and LA are safe methods to treat AA. The rate of postoperative complications and the length of an OA operation have been decreasing progressively over the years; however, a preference for LA has been increasing over time. As for gallbladder operations, LA is likely to be the gold standard in AA treatment.

Keywords: Acute appendicitis; appendectomy; laparoscopic; open appendectomy.

Introduction

Acute appendicitis (AA) is the most prevalent surgical disease with a 7–8% of life long incidence risk.^[1] Appendectomy is the most preferred treatment method. McBurney^[2]

have described still widely used appendectomy technique in 1894. In 1980, Semm^[3] has performed the first laparoscopic appendectomy. However, a genuine “laparoscopic revolution” has occurred after Erich Muhe has performed



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the first laparoscopic cholecystectomy in 1985 by employing Semm's technique and instruments.^[4] Initially laparoscopy wasn't a widely used technique, because it wasn't considered a safe method. Today, laparoscopic surgery is the primary choice in many surgical procedures. Open appendectomy (OA) with its low mortality and morbidity rates is considered as the golden standard for AA, but after proven safety of the laparoscopic appendectomy (LA) it has been increasingly employed in surgical treatment of AA.^[5,6] Shorter hospital stay and rapid return to normal daily activities, less post-op pain and lower wound site infection are reported as the advantages of LA.^[5,7,8] In addition, laparoscopic approach is important because of probable misdiagnosis especially in fertile women.^[9] However, in the studies of Tzovaras et al.^[9] and Ingraham et al.,^[10] higher cost and longer operation time was reported and no additional benefit was recorded in patient recovery. Technological improvements and increasing experience of the surgeons on laparoscopy progressively improves the positive results.^[6] Debate over superiority of LA or OA in surgical treatment of AA in particular patient groups is still ongoing. Our aim is to assess our results under the guidance of literature in order to make a contribution in determination of the optimal surgical procedures for acute appendicitis treatment.

Materials and Methods

After approval of the local ethics committee patients chart and electronic data of 1587 patients who have undergone appendectomy by OA or LA in our hospital between June 2014 and August 2018 were retrospectively reviewed. Patients requiring switch to open surgery after the laparoscopically initiated surgery, negative laparascopi or laparotomi, patients younger than 18 years, pregnant patients and patients having additional pathology other than acute appendicitis have been excluded from the study. Since most of the pathology findings could not be reached, they were not included.

Age, sex, duration of operation, hospital stay, complications requiring post-op hospitalization and wound site infections were assessed. The results were compared statistically and evaluated under the guidance of the literature.

The diagnosis was made by USG control or CT after physical examination. Under general anesthesia LA was performed by a three-trocar technique. A 10 mm port was placed at the umbilicus, first 5 mm port was placed in the left lower abdominal quadrate and second 5 mm port was placed in the suprapubic area. Appendix stump was lig-

ated by endo-loops (Vicryl 2/0 ethicon) and divided with laparoscopic scissors. Using 5 mm optics the specimen was extracted through the umbilical trocar. A drain was placed into the rectovesical area, if necessary. OA was performed McBurney incision. The mesoappendix was ligated, and the appendix was divided at the base and removed. A drain was placed into the rectovesical area, if necessary. Preoperative 1 g cephazolin sodium was given i.v. to all patients prophylactically. Antibiotherapy continued during the hospital stay in all perforated patients. It was completed to ten days orally after the patients were discharged. In non-perforated patients antibiotherapy wasn't maintained after prophylactic use.

Statistical analysis was carried out by SPSS version 17.0. Conformity of variables to normal distribution was assessed by histogram graphics and Kolmogorov-Smirnov test. Mean, standard deviation, median and minimum-maximum were used in descriptive analysis. Categorical data were compared by Pearson Chi square and Fisher's Exact Test. Inter group assessment of variables with non-normal distribution (non-parametric) was carried out by using Mann-Whitney U Test. Values $p < 0.05$ were considered statistically significant.

Results

877 male (61.6%) and 546 female (38.4%) patients totaling 1423 were included into the study. 771 (54.2%) of the patients have undergone open appendectomy and 652 patients (45.8%) have undergone laparoscopic appendectomy. Mean age of patients was 32.27 ± 11.85 years, duration of operation was 59.77 ± 20.24 min, follow up was 24.46 ± 13.70 months and hospital stay was 1.61 ± 1.14 days.

In 42 patients (2.9%) complications requiring hospitalization have occurred. 9 (0.6%) patients had subileus, 9 (0.6%) patients had wound site infection, 9 (0.6%) patients had post-op abdominal pain, 7 (0.5%) patients had intraabdominal abscess, 3 (0.2%) patients had stump leakage, 2 (0.1%) patients had bridge ileus and 1 (0.07%) patient had incisional hernia, 1 (0.07%) patient had trocar site hernia and 1 (0.07%) patient had omentum as content of drain site hernia. In 10 patients (0.7%) requiring hospitalization operation was indicated.

Out of 7 patients with abdominal abscess only two who had this complication after OA were re-operated. After drainage of the abscess by open method a drain was inserted. In two patients bridge ileus has occurred after OA. Both patients were treated (by bridectomy). There was no

bridge ileus in patients who had undergone LA. Stump leakage has occurred in two patients after OA and in one patient after LA. In one patient primary closure was done but in two patients ileostomy was established in addition to primary closure due to abdominal contamination and co-morbidity. There was no mortality (Table 1).

Assessment of patients according to indication for re-hospitalization and re-operation in terms of type of operation didn't reveal any significant result ($p>0.05$).

Age, sex, duration of the operation and hospital stay was compared according to the type of operation. Mean duration of operation with open appendectomy was (58.82 ± 20.90 min) was shorter than laparoscopic appen-

dectomy (60.88 ± 19.38 min) ($p=0.002$). Mean follow up of patients who had undergone laparoscopic appendectomy (26.60 ± 13.37 months) was longer compared to laparoscopic appendectomy (21.92 ± 13.67 months) ($p<0.001$). Percentage of male patients (65.50%) within open appendectomy cases was higher compared to laparoscopic appendectomy (57.06%) and percentage of female patients (42.94%) were higher with laparoscopic appendectomy compared to open appendectomy (34.50%) ($p=0.001$) (Table 2).

Discussion

Lower incidence of surgical site infection, shorter duration of post-op hospital stay, less pain, lower incidence

Table 1. Percentage of the complications according to the type of operation in terms of post-op indication for rehospitalization hospital stay and re-operation

	Type of operation				p
	Open appendectomy (n=771)		Laparoscopic appendectomy (n=652)		
	n	%	n	%	
Complications requiring re-hospitalization					
Abscess drainage	77	9.99	59	9.05	0.549
Total	27	3.50	15	2.30	0.210
Intraabdominal abscess	5	0.64	2	0.30	0.738
Subileus	5	0.64	4	0.61	
Wound site infection	5	0.64	4	0.61	
Bridge Ileus	2	0.25	0	0.00	
Incisional hernia	1	0.12	0	0.00	
Postop abdominal pain	6	0.77	3	0.46	
Trocar site hernia	0	0.00	1	0.15	
Stump leakage	2	0.25	1	0.15	
Omentum as content of drain site hernia	1	0.12	0	0.00	
Complications requiring re-operation					
Total	8	1.03	2	0.30	0.1
Intraabdominal abscess	2	0.25	0	0.00	0.323
Subileus	0	0.00	0	0.00	
Woundsite infection	0	0.00	0	0.00	
Bridge Ileus	2	0.25	0	0.00	
Incisional hernia	1	0.12	0	0.00	
Postop Abdominal pain	0	0.00	0	0.00	
Trocar site hernia	0	0.00	1	0.15	
Stump leakage	2	0.25	1	0.15	
Omentum as content of drain site hernia	1	0.12	0	0.00	

¹Chi-SquareTest.

Table 2. Comparison of age and duration of the operation and hospital stay according to the type of operation

	Type of operation				p ¹
	Open appendectomy		Laparoscopic appendectomy		
	Mean±SD	Median	Mean±SD	Median	
Age	32.19±11.89	30.00	32.36±11.81	31.00	0.796
Duration of operation	58.82±20.90	55.00	60.88±19.38	60.00	0.002
Follow up	26.60±13.37	25.22	21.92±13.67	20.84	<0.001
Duration of hospital stay	1.58±1.17	1.00	1.65±1.11	1.00	0.061
Sex, n (%)					
Male	505 (65.50)		372 (57.06)		0.001 ²
Female	266 (34.50)		280 (42.94)		

¹Mann Whitney U Test. ²Chi-SquareTest. SD: Standard deviation.

of incisional hernia and shorter time requirement for post-op recovery and returning to normal daily activities are reported as advantages of laparoscopic approach.^[11–15] However, because of lower cost, shorter duration of operation and no demand for higher surgical skills OA is still widely employed.^[5,11,16,17] In a meta-analysis carried out by Li et al.^[5] it was found that in studies before 2000 duration of operation was 15.14 min longer with LA compared to OA but this difference was only 8.67 min in the studies that were performed in the following years. As the experience of the surgeons increase, duration of operation became closer to each other between two methods.^[18] In our study LA was mean 2,06 min longer compared to OA.

According to Tamjeed Gul et al.^[19] rate of males was higher among acute appendicitis patients compared to females. We had a similar result in our study. It was reported that LA is employed higher percentage of females compared to males.^[20,21] This may stem from higher number of conditions in females that may lead to an acute appendicitis misdiagnosis compared to males and thus desire of surgeons to start the procedure as a diagnostic laparoscopy in females and then proceed to the actual operation if needed and preference of females due to cosmetic considerations.^[20,21] In our study also LA was higher in females. Preference of LA in treatment of acute appendicitis has been progressively increasing over years. In 2000 LA preference rate was 26% and the rate was reported as 69% in 2013.^[20] In our study follow up period was longer in OA. In accordance with the literature our preference for LA has also progressively increased over years.

In the study of Sartelli et al.^[22] median age of the disease was found as 29 years and thus they have reported that the disease affects young population. We had results similar to this study. In the study of Sartelli et al.^[22] median hospital stay was 3 days, Ceresoli et al.^[20] have reported mean 5.19 days for hospital stay in their meta-analysis. In our study hospital stay was shorter and there was no statistical difference in terms of hospital stay in both groups.

In different studies varying rate of wound site infection has been reported and their mean rate was reported as 12.5% (LA) and 14% (OA).^[10,21,23,24] In our study wound site infection rate was lower than these figures by both methods and there was no significant difference between OA and LA.

In the study of Sartelli et al.^[22] re-operation rate during the post-op period was reported as 1.3%. In our study re-operation rate was lower with both methods compared to the study of Sartelli et al. and there was no significant difference between OA and LA. Incidence of post-op complication is reported as between 3%–28.7% in the literature.^[25,26] Most commonly reported complications in the literature are small intestine obstruction, surgical site infection, stump leakage, abdominal abscess and stump appendicitis.^[27,28] Abdominal abscess is a commonly encountered complication and its incidence is reported between 1.5%–8%.^[28,29] In our series there was stump appendicitis. Other complications and their incidence were in accordance with the literature. When compared rate of all complications, complication requiring re-hospitalization and complications requiring reoperation was lower with LA. However, the difference wasn't statistically significant.

Limitation of our study is its design being retrospective. Moreover, returning to normal daily activities and parameters of post-op pain weren't assessed.

OA and LA are both safe methods in treatment of AA. Post-op complications and duration of operation for LA have been improving during the past years. Preference of LA in treatment of acute appendicitis has been progressively increasing over years. As in gall bladder surgery AL also becomes golden standard in the treatment of AA.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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