



# Obesity and appendicitis: Laparoscopy versus open technique

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## ABSTRACT

**Objective:** The clinical results of obese patients who have undergone open or laparoscopic appendectomy, whether one technique is superior to the other is still not clearly known. In our study, we compared the clinical results of obese patients operated with laparoscopic or open technique for acute appendicitis.

**Material and Methods:** We performed retrospective analyses of patients operated for acute appendicitis between the dates of July 2016 and July 2019 at Istinye University Faculty of Medicine Bahcesehir Liv Training and Research Hospital and Liv Hospital Ankara. Of the 241 patients whose height and weight information was accessible, 57 had a body mass index of 30 kg/m<sup>2</sup> or higher. Eighteen of these patients underwent open surgery while the other 39 underwent laparoscopic surgery. The primary result criterion was complication ratio. Secondary criteria were operation time and length of hospital stay.

**Results:** Upon comparison of laparoscopic and open techniques in terms of intraoperative-postoperative complications (p= 0.01), operation time (p= 0.02) statistically significant differences were found between the groups. However the mean length of hospital stay (p= 0.181) was similar in both groups.

**Conclusion:** In obese appendicitis patients, the laparoscopic technique proved to be superior to the open technique in criteria such as perioperative-postoperative complications, operation time, and etc. Length of hospital stay was determined to be similar between the groups.

**Keywords:** Appendicitis, obesity, body mass index, laparoscopic appendectomy, open appendectomy

## INTRODUCTION

Laparoscopic techniques have been more and more preferred to open surgical techniques due to reasons such as less post-operative pain, faster return to daily life and activities, and cosmetic advantages (1,2). Laparoscopic appendectomy (LA) was first described in 1983 (3). Lesser risk of intraoperative complication, fewer surgical site infections and shortened hospital stays stand out in obese patient groups operated with laparoscopic techniques (4,5). Medical literature related to appendectomy also shows superiority of laparoscopy especially in terms of wound site infections, postoperative recuperation period and out-of-hospital costs. That said, the literature also shows a correlation between laparoscopy and certain situations such as increased ratio of intra-abdominal abscess and increased hospital costs (6). In obese patients, due to the abdominal wall being thicker, difficulty may be encountered in revealing the surgical field, performing surgical techniques and wound related situations. Laparoscopy overcomes these issues and creates the belief that laparoscopy is better than open appendectomy (OA) for appendicitis. While some research shows that LA is a safe and efficient treatment method for both acute and perforated appendicitis, some others show that the open technique is superior (7-9). That said, when the data is limited to the obese population, the discussion whether there is a difference remains. Our objective is to determine whether there is a difference between OA and LA for patients grouped according to their body mass indexes (BMI).

## MATERIAL and METHODS

We retrospectively examined the patients who underwent an operation for acute appendicitis at our institutions between the dates of July 2016 and July 2019.

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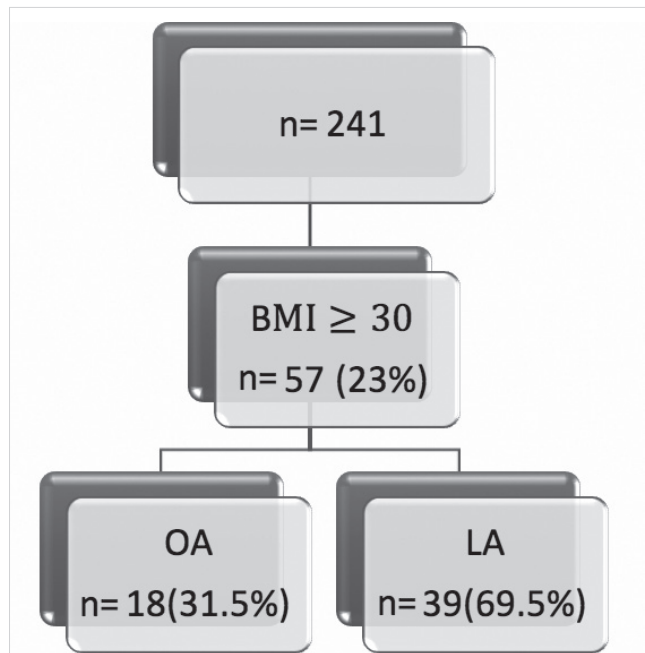
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**Patient Selection**

We separated patients with clinical appendicitis diagnosis into two groups, LA and OA. We followed up on the patients during their hospital stay and for 2 weeks after their discharge at the out-patient clinic. All patients were 16 or above (Figure 1).



**Figure 1.** Body mass index (BMI) of 23% of the 241 patients was at or above 30 kg/m<sup>2</sup>. In 18 of these patients (31.5%) open appendectomy (OA) was performed, and laparoscopic appendectomy (LA) was performed on the other 39 (69.5%).

**Data**

We examined the demographic data (age, sex), preoperative data [white blood cell (WBC), diagnosis], operation details (operation type, duration) and post-operative period (complications, length of hospital stay) of the patients.

**Subgroup Analysis**

We divided the patients into 3 subgroups according to their BMI's: BMI of lower than 25 kg/m<sup>2</sup>, BMI between 25-30 kg/m<sup>2</sup> (overweight) and BMI of 30 kg/m<sup>2</sup> or above (obese).

**Result Criteria**

The primary criterion was complication ratio. Secondary criteria were operation time and length of hospital stay.

**Statistical Methodology**

We used SPSS 17. version. Data ranges were presented with median and percentages values. To compare the ratios of statistical significance, we used Mann-Whitney U test. Values with a p value of less than 0.05 were deemed statistically significant.

Ethics committee approval was received for this study from the Ethics Committee of Istinye University (No. 2019/1951) and Liv Hospital Ankara ( No. 2019/006).

**RESULTS**

Both groups were similar in age (OA= 33, LA= 31, p= 0.771), sex (OA= 61% male, LA= 52% male, p= 0.724) and presented with clinical appendicitis (confirmed with pathology p= 0.165) (Table 1). A statistically significant difference in favor of the laparoscopic group was observed in the ratio of complications between the open and laparoscopic groups categorized according to their BMIs (p= 0.01) (Table 2). No mortality occurred over the course

**Table 1.** Demographics and pathologies of the obese patients grouped according to types of operation

	OA (n= 18)	LA (n= 39)	p
Sex	61% male	52% male	0.724
Age (range)	33 (17-48)	31 (18-59)	0.771
Pathology (%)			
Normal	7%	4%	0.165
Acute	29%	61%	
Perforated/Gangrenous	64%	35%	

OA: Open appendectomy, LA: Laparoscopic appendectomy.

**Table 2.** Complications according to types of operation

	OA	LA
Wound site infection	3	-
Left inferior epigastric artery injury		1
Ileus	1	
Peritoneal findings	1	
Intra-abdominal abscess-hematoma	3	1

OA: Open appendectomy, LA: Laparoscopic appendectomy.

**Table 3.** Results

	OA (n= 18)	LA (n= 39)	p
Complications (patient count)	8	2	0.01
Operation time (minutes)	61 (40-119)	45 (29-134)	0.02
Mean length of hospital stay: days (range)	2 (1-6)	2 (1-5)	0.181

OA: Open appendectomy, LA: Laparoscopic appendectomy.

of this study. Upon comparison of the laparoscopy group to the open technique group, operation time of the laparoscopy group was observed to be shorter ( $p= 0.02$ ). No statistically significant difference was observed in the length of hospital stay of the groups ( $p= 0.181$ ) (Table 3).

## DISCUSSION

Comparison discussions between OA and LA continues with numerous papers. There are some meta-analyses that go over this subject in the literature. In a meta-analysis dated 2004 where 54 studies were analyzed, LA was shown to result in distinctly fewer wound infections, less pain and shorter hospital stay; however a correlation was shown between it and higher cost with an increased risk of prolonged operation time and intra-abdominal infections. The conclusion was that LA is the better option for patient groups consisting of working population, young women and obese people (6). In another meta-analysis, similarly, LA procedure was reported to result in a higher probability of intra-abdominal abscess while also being superior in terms of wound infections and length of hospital stay. The analysis recommended to avoid LA in perforated and gangrenous appendicitis cases (10). In a double-blind, prospective, randomized study dated 2005 comparing LA and OA, no superiority of one procedure to the other was observed other than a better quality of life at the 2nd week after operation for the LA group (1). As for our study, we performed analyses to demonstrate whether the two procedures created different results among the patients grouped up according to their BMIs. Our study demonstrated that the laparoscopic approach was more advantageous for obese patients in terms of complications and operation time. Previous studies conducted regarding obese patient groups have not been as comprehensive as the ones conducted among the general population (11-14). In another retrospective study, length of hospital stay and wound recuperation period were shown to be superior for obese patients that underwent laparoscopic appendectomy than their counterparts who underwent operations where the open technique was used (15). Varela et al. have also reached similar conclusions such as lower complication rates and costs for morbidly obese people. Many studies that reach the opposite conclusion have also been published. Ricca et al. have found LA to result in significantly longer operation time and higher costs (12,16). Towfigh et al. have found no significant difference between the laparoscopic and open approaches in terms of length of hospital stay or complication ratio (17). The reason for

the varying results may also be the experiences of the teams studying obese patients. Operation times and wound side infection ratios may potentially be affected, and when it comes to discharging a patient, the initiative of clinical discretion may also affect the length of hospital stay. Factoring in the variables tied to the operating surgeon, the surgical techniques also need to be standardized. Appendectomy is generally a short-lasting operation that is performed with a small incision (4-6 cm). Some studies show that the McBurney incision is superior to the median line incision in terms of pain, complications and wound site healing (18). When compared to other open techniques, OA results in less operation site pain and shorter hospital stays for pain management (19,20). In addition, in the literature, a higher rate of trocar site hernia is reported in appendectomies performed with a single port compared to LAs (21). The parameter that affects the length of hospital stay of appendectomy patients is the severity of the infection encountered during the operation. Post-operative antibiotherapy of the patients with ruptured or gangrenous appendicitis may also prolong hospital stay. The risk of complications caused by prolonged operation times of obese patients such as atrial fibrillation, pulmonary embolism, deep vein thrombosis (DVT) and rhabdomyolysis are not disregarded (22-26). In patients with a BMI of over 40 kg/m<sup>2</sup>, while the risk of atrial fibrillation may increase by 50%, the risk of DVT or pulmonary embolism may increase by up to 3 times. In many studies, laparoscopy and obesity have been shown as independent factors for prolonged operation times (27-29). However, in our study, we recorded significantly shorter operation times in obese patients who underwent LA. We also observed the superiority of LA over OA in terms of complication frequency.

## Limitations of the Study

One of the limitations of this study may have been ensuring that the operations would be performed by surgeons with high experience of operating on obese people. It must not be overlooked that the operation time, post-operative follow-up and treatment processes and even the decisions given regarding the patients' discharge may be affected by the said experience. In addition, 44 obese appendicitis patients were a rather small sample size for observation.

## CONCLUSION

According to our data, technically, we recommend LA to obese patients, however, we are of the opinion that it should be shaped

according to clinical conditions and the discretion and experience of the surgeon.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Istinye University (No. 2019/1951) and Liv Hospital Ankara (No. 2019/006).

**Informed Consent:** Not required in this study.

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**Conflict of Interest:** The authors have no conflicts of interest to declare.

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## REFERENCES

- Clarke T, Katkhouda N, Mason RJ, Cheng BC, Olasky J, Sohn HJ, et al. Laparoscopic versus open appendectomy for the obese patient: a subset analysis from a prospective, randomized, double-blind study. *Surg Endosc* 2011;25(4):1276-80. [CrossRef]
- Nguyen NT, Zainabadi K, Mavandadi S, Paya M, Stevens CM, Root J, et al. Trends in utilization and outcomes of laparoscopic versus open appendectomy. *Am J Surg* 2004;188(6):813-20. [CrossRef]
- Semm K. Endoscopic appendectomy. *Endoscopy* 1983;15(2):59-64. [CrossRef]
- Nguyen NT, Goldman C, Rosenquist CJ, Arango A, Cole CJ, Lee SJ, et al. Laparoscopic versus open gastric bypass: a randomized study of outcomes, quality of life, and costs. *Ann Surg* 2001;234(3):279. [CrossRef]
- Lujan JA, Frutos MD, Hernandez Q, Liron R, Cuenca JR, Valero G, et al. Laparoscopic versus open gastric bypass in the treatment of morbid obesity: a randomized prospective study. *Ann Surg* 2004;239(4):433. [CrossRef]
- Sauerland S, Jaschinski T, Neugebauer EA. Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database Syst Rev* 2010;(10). [CrossRef]
- Roscio F, Clerici F, Armiraglio L, Scandroglio I. Acute appendicitis in obese patients. *Emergency Surgery in Obese Patients*. Cham: Springer, 2020:59-64. [CrossRef]
- Moberg AC, Berndsen F, Palmquist I, Petersson U, Resch T, Montgomery A. Randomized clinical trial of laparoscopic versus open appendectomy for confirmed appendicitis. *Br J Surg* 2005;92(3):298-304. [CrossRef]
- Gorter RR, Eker HH, Gorter-Stam MA, Abis GS, Acharya A, Ankersmit M, et al. Diagnosis and management of acute appendicitis. EAES consensus development conference 2015. *Surg Endosc* 2016;30(11):4668-90. [CrossRef]
- Bennett J, Boddy A, Rhodes M. Choice of approach for appendectomy: a meta-analysis of open versus laparoscopic appendectomy. *Surg Laparosc Endosc Percutan Tech* 2007;17(4):245-55. [CrossRef]
- Mason RJ, Moazzez A, Moroney JR, Katkhouda N. Laparoscopic vs. open appendectomy in obese patients: outcomes using the American College of Surgeons National Surgical Quality Improvement Program database. *J Am Coll Surg* 2012;215(1):88-99. [CrossRef]
- Varela JE, Hinojosa MW, Nguyen NT. Laparoscopy should be the approach of choice for acute appendicitis in the morbidly obese. *Am J Surg* 2008;196(2):218-22. [CrossRef]
- Khuri SF, Daley J, Henderson W, Barbour G, Lowry P, Irvin G, et al. The National Veterans Administration Surgical Risk Study: risk adjustment for the comparative assessment of the quality of surgical care. *J Am Coll Surg* 1995;180(5):519-31. [CrossRef]
- Ricca R, Schneider JJ, Brar H, Lucha Jr PA. Laparoscopic appendectomy in patients with a body mass index of 25 or greater: results of a double blind, prospective, randomized trial. *JLS* 2007;11(1):54. [CrossRef]
- Corneille MG, Steigelman MB, Myers JG, Jundt J, Dent DL, Lopez PP, et al. Laparoscopic appendectomy is superior to open appendectomy in obese patients. *Am J Surg* 2007;194(6):877-81. [CrossRef]
- Kapischke M, Caliebe A, Tepel J, Schulz T, Hedderich J. Open versus laparoscopic appendectomy. *Surg Endosc* 2006;20(7):1060. [CrossRef]
- Towfigh S, Chen F, Katkhouda N, Kelso R, Sohn H, Berne TV, et al. Obesity should not influence the management of appendicitis. *Surg Endosc* 2008;22(12):2601-5. [CrossRef]
- Halm JA, Lip H, Schmitz PI, Jeekel J. Incisional hernia after upper abdominal surgery: a randomised controlled trial of midline versus transverse incision. *Hernia* 2009;13(3):275-80. [CrossRef]
- Tuggle KRM, Ortega G, Bolorunduro OB, Oyetunji TA, Alexander R, Turner PL, et al. Laparoscopic versus open appendectomy in complicated appendicitis: a review of the NSQIP database. *J Surg Res* 2010;163(2):225-8. [CrossRef]
- Harju J, Juvonen P, Eskelinen M, Miettinen P, Pääkkönen M. Minilaparotomy cholecystectomy versus laparoscopic cholecystectomy. *Surg Endosc* 2006;20(4):583-6. [CrossRef]
- Antoniou SA, Morales-Conde S, Antoniou GA, Pointner R, Granderath FA. Single-incision laparoscopic cholecystectomy with curved versus linear instruments assessed by systematic review and network meta-analysis of randomized trials. *Surg Endosc* 2016;30(3):819-31. [CrossRef]
- Flier S, Knape JTA. How to inform a morbidly obese patient on the specific risk to develop postoperative pulmonary complications using evidence-based methodology. *Eur J Anaesthesiol* 2006;23(2):154-9. [CrossRef]
- Bamgbade OA, Rutter TW, Nafiu OO, Dorje P. Postoperative complications in obese and nonobese patients. *World J Surg* 2007;31(3):556-60. [CrossRef]
- Rocha AT, de Vasconcellos AG, da Luz Neto ER, Araujo DM, Alves ES, Lopes AA. Risk of venous thromboembolism and efficacy of thromboprophylaxis in hospitalized obese medical patients and in obese patients undergoing bariatric surgery. *Obes Surg* 2006;16(12):1645-55. [CrossRef]
- Cushman M. Epidemiology and risk factors for venous thrombosis. *Semin Hematol* 2007;44(2):62-9. [CrossRef]
- Dasari BV, Baker J, Markar S, Gardiner K. Laparoscopic appendectomy in obese is associated with improvements in clinical outcome: systematic review. *Int J Surg* 2015;13:250-6. [CrossRef]
- Ettinger JE, de Souza CAM, Azaro E, Mello CA, Santos-Filho PV, Orrico J, et al. Clinical features of rhabdomyolysis after open and laparoscopic Roux-en-Y gastric bypass. *Obes Surg* 2008;18(6):635-43. [CrossRef]
- Flancbaum L, Choban PS. Surgical implications of obesity. *Ann Rev Med* 1998;49(1):215-34. [CrossRef]
- Hawn MT, Bian J, Leeth RR, Ritchie G, Allen N, Bland KI, et al. Impact of obesity on resource utilization for general surgical procedures. *Ann Surg* 2005;241(5):821. [CrossRef]



## ORJİNAL ÇALIŞMA-ÖZET

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### Obezite ve apandisit: Laparoskopik ile açık teknik karşılaştırılması

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#### ÖZET

**Giriş ve Amaç:** Açık veya laparoskopik apendektomi yapılan obez hastaların klinik sonuçlarına göre, yöntemlerin birbirine üstünlüğünün olup olmadığı hala net olarak bilinmemektedir. Çalışmamızda akut apandisit nedeniyle laparoskopik veya açık yöntemle opere edilen obez hastaların klinik sonuçları karşılaştırıldı.

**Gereç ve Yöntem:** Temmuz 2016-Temmuz 2019 tarihleri arasında, İstinye Üniversitesi Liv Hospital Bahçeşehir ve Liv Hospital Ankara hastanelerinde akut apandisit nedeniyle opere edilen hastaların retrospektif analizleri yapıldı. Boy ve kilosuna ulaşılabilen 241 hastanın 57'sinde beden kütle indeksi 30 kg/m<sup>2</sup> veya daha fazla idi. Bu hastaların 18'ine açık cerrahi, 39'una laparoskopik cerrahi uygulandı. Primer sonuç ölçütleri komplikasyon oranlarıydı. İkincil sonuçlar ameliyat süresi ve hastanede kalış süresi idi.

**Bulgular:** Laparoskopik ve açık yöntem perioperatif-postoperatif komplikasyonlar (p= 0,01) ve operasyon süresi (p= 0,02) açısından kıyaslandığında gruplar arasında istatistiksel olarak anlamlı farklılıklar bulunmuştur. Ancak hastanede hastanede yatış süresi açısından gruplar arasında anlamlı fark yoktur (p= 0,181).

**Sonuç:** Apandisit nedeniyle opere edilen obez hastalarda, laparoskopik yöntem ile opere edilen grupta açık yöneme kıyasla daha az perioperatif-postoperatif komplikasyonlar, daha kısa operasyon süresi gibi üstünlüklerin olduğu gözlemlendi. Gruplar arasında hastanede yatış süresinin benzer olduğu tespit edildi.

**Anahtar Kelimeler:** Apandisit, obezite, beden kütle indeksi, laparoskopik apendektomi, açık apendektomi

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