

LAPAROSCOPIC VERSUS OPEN APPENDECTOMY IN MORBIDLY OBESE PATIENTS: RETROSPECTIVE STUDY

Mohamed S Essa, Mohamed E Zayed

Department of General Surgery, Benha University Hospital,
Faculty of Medicine, Benha University, Benha, Egypt

ABSTRACT

Background: We are trying to detect the optimum approach for appendectomy in morbidly obese patients by evaluating laparoscopic appendectomy (LA) and open appendectomy (OA) techniques applied in this group of patients.

Material and Methods: The records of 314 patients who underwent appendectomy for acute appendicitis between August 2016 and August 2018 were analyzed retrospectively. Exclusion criteria were: those under 18 years, body mass index (BMI) 40 kg/m², and those with a perforation and/or appendicular mass. The remaining 105 patients were involved in the study. The patients were classified into 2 groups: group A, includes 50 patients underwent LA and group B, includes 55 patients underwent OA. Socio-demographic data, operative time, surgery-related superficial surgical site infection (sSSI), intra-abdominal complication, non-surgical complication, and length of postoperative hospital stay were recorded.

Results: No statistically significant variations was detected between LA and OA groups in terms of age and gender ($P=0.51$, $P=0.69$ respectively). However, the average BMI value in the LA group was found to be significantly higher

($P<0.001$). Operative duration and length of hospital stay were shown to be significantly lower in the LA group ($P<0.001$, $P<0.001$, respectively). Overall complications and superficial SSI were found to be significantly lower in the LA group ($P=0.023$, $P=0.032$, respectively).

Conclusion: In spite of LA did not have an obvious advantage over OA in morbidly obese patients; it should be emphasized that laparoscopic surgery may be preferred because of many advantages such as a shorter length of postoperative hospital stay and minimal risk of SSI.

INTRODUCTION

Background:

Acute appendicitis is an inflammation of vermiform appendix. It is one of the most common causes of abdominal pain and one of the most common indications for an emergency abdominal surgery all-over the world (Williams, 1983; Von Titte et al., 1996). The incidence is approximately 233/100,000 population and is highest in the 10-to-19-year-old age group. It occurs most commonly in the second and third decades of life. Acute appendicitis is higher among males (male to female ratio of 1.4:1), who have a lifetime incidence of 8.6% compared with 6.7% for females (Noudeh et al., 2007).

The prevalence of obesity increase in the world since 1980 and become the double, and it has been reported to be approximately 12% (Afshin et al., 2017). Now obesity is a common problem, so general surgeons will have to undergo appendectomy in morbidly obese patients, with an increasing frequency. Open surgery in morbidly obese patients is associated with larger wounds, more postoperative pain and more pulmonary complications than normal weight population (Delaney et al., 2005). One study reported, although LA had an advantage in terms of shorter postoperative hospital stay in comparison to OA, it was reported that it has some disadvantages, such as longer operative time (Mc Burney, 1894).

So, unlike laparoscopic cholecystectomy for gall bladder stones, LA has still not become the standard approach in the management of acute appendicitis. Considering that the difficulties of abdominal surgery can be even greater in the morbidly obese patients, detection of the ideal approach for appendectomy for this type of patients becomes more important.

We are trying in the current study to detect the ideal technique for appendectomy in this patient group by evaluating both approaches (LA and OA) in morbidly obese patients.

MATERIAL AND METHODS

Study design:

This was a retrospective analysis of 314 patients who underwent appendectomy for acute appendicitis between August 2016 and August 2018, 196 patients excluded from the study based on exclusion criteria (84 patients <18 years, 91

patients with BMI < 40Kg/m² and 21 patients with perforated and appendicular mass). We could not access the data of 13 of morbidly obese patients and underwent appendectomy. The data of the remaining 105 patients were analysed (Figure 1). This study was conducted at the general surgery department, Benha university hospital.

Inclusion criteria:

1. Age \geq 18 years.
2. BMI \geq 40.

Exclusion criteria:

1. Age < 18 years.
2. BMI < 40.
3. Perforated appendix.
4. Appendicular mass.

After the approval of the study by the ethical committee of Faculty of Medicine, Benha University, and after obtaining written informed consent from the patients for participation in the study, patients were fully informed about the hazards and benefits of the surgery. The patients were divided into two groups: group A, includes 50 patients underwent laparoscopic appendectomy (LA) and group B includes 55 patients underwent open appendectomy (OA). Preoperative full detailed history, physical examination, routine laboratory investigation and abdominal computed tomography (CT) to confirm the diagnosis of acute appendicitis. Demographic data, operative time, SSI, intra-abdominal complications, non-operative complications, and duration of hospital stay were recorded.

Operative technique:

All patients received venous thrombo-embolic (VTE) prophylaxis at the beginning of surgery in the form of elastic stocking and subcutaneous injection of 5000 IU heparin. In addition to prophylactic antibiotics 1 hour before the incision time.

A. Open appendectomy (OA)

OA was done via McBurney incision. The mesoappendix was dissected and ligated. After the appendix was removed, the appendix stump was closed with Z-suture or purse-string suture.

B. Laparoscopic appendectomy (LA)

In LA, three ports (infra umbilical, suprapubic, and left lower quadrant) was used. In two cases, the 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 left lower quadrant port with the help of a Lap-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 techniques, the operative time (minutes) was recorded from the time of skin incision until the skin closure was completed. The postoperative hospital stay was detected [postoperative number of nights spent in the hospital]. The intra-abdominal abscess was defined

as a collection diagnosed by ultrasonography (U/S) or CT or as aspirating purulent content under U/S guidance.

Postoperative management:

Liquid diet started 3 hours after surgery then the diet advanced to regular diet. Patients without drain discharged on the next morning while the patient with drain, the drain removed when the discharge is minimal and the patient discharged.

Statistical Analysis

The SPSS 22.0 (Statistical Package for Social Sciences, IBM Inc., Chicago, IL, USA) package program was used for statistical analysis of the data. A chi-square test was used to compare the groups related to categorical variables. In the parametric data, a Student's t-test was used in the comparison of the two groups, and the Mann-Whitney U test was used for non-parametric data. A p-value of less than 0.05 was considered statistically significant.

RESULTS

There were 50 patients in the group A (LA) and 55 patients in the group B (OA). There was no significant difference between the two groups regarding age and gender. However, the average BMI value in the group A was found to be statistically significantly higher than in the group B. Furthermore, there was no significant difference in comorbidities between both groups. Socio-demographic and comorbidity data are summarized in Table-1. It was found that the average duration of surgery in the group A was significantly shorter than the group B. In addition, the average length of postoperative hospital stay in

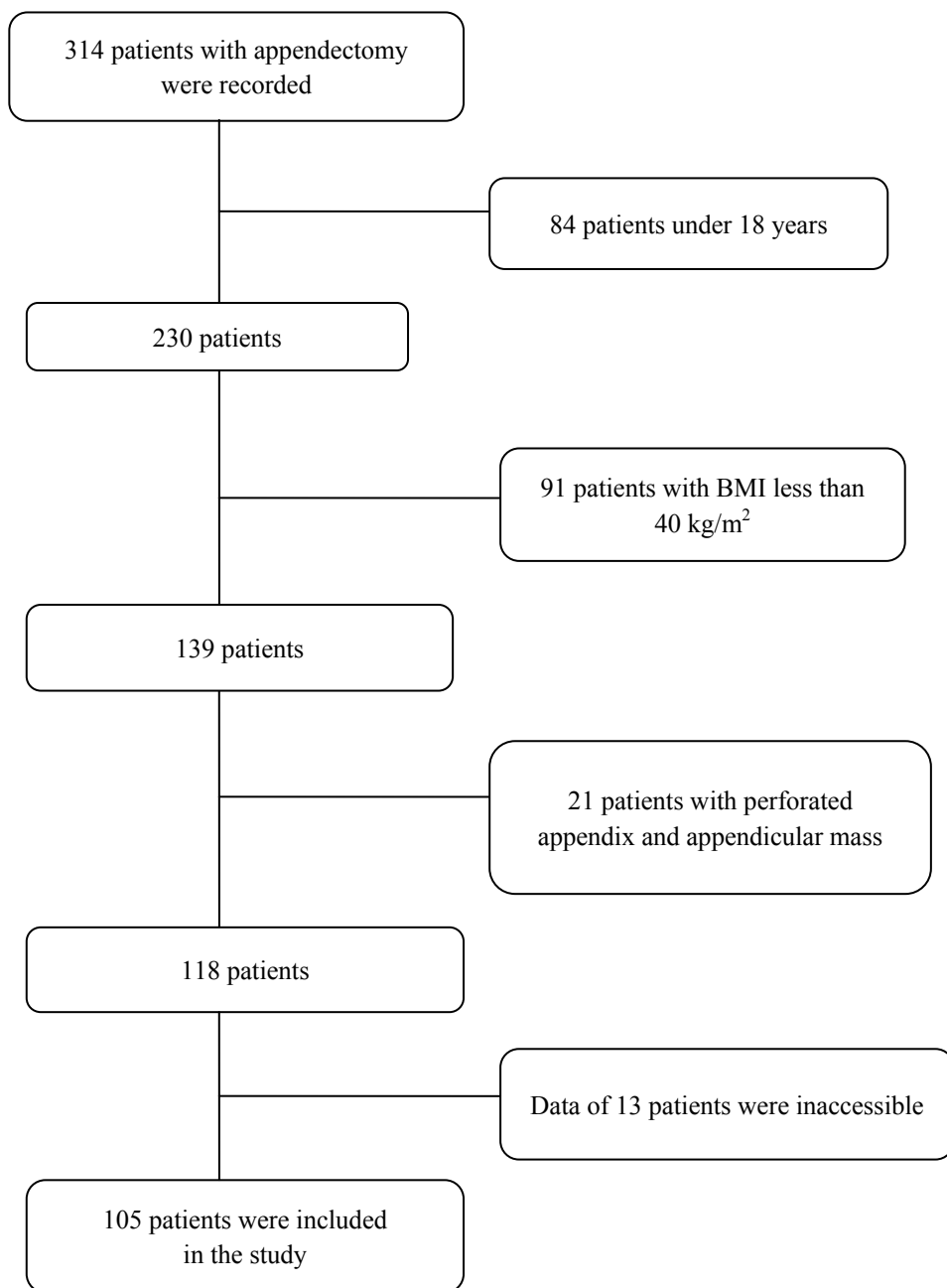


Figure (1): Flow chart for the patients included in the study.

the group A was found to be significantly shorter in comparison to group B. Data on the operative time and the length of hospital stay are shown in Table-2. None of the patients who underwent LA required conversion to open surgery. Regarding complications in our study, it was found that complications in the group A were significantly lower compared to the group B. In the group A, 3 patients (6%) developed intra-abdominal

abscess, and 2 patients (4%) developed surgical site infection (SSI) and chest infection, while in the group B, 10 patients (18.2%) had sSSI, 3 patients (7.3%) had an intra-abdominal abscess, 4 patients had pneumonia (9.1%) 1 patient had sSSI and intra-abdominal abscess, and 1 patient had pneumonia and sSSI. Data on postoperative complications are illustrated in Table-2. No mortality was recorded in both groups.

Table (1): Demographic and comorbidities data

	Group A (LA) <i>n</i> =50	Group B (OA) <i>n</i> =55	<i>p</i> value
Age (mean ±SD)	35.26±4.71	37.42±5.63	0.51
BMI (kg/m²) (mean ±SD)	43.10±3.23	40.72±1.56	<.001
Gender			
Female <i>n</i> (%)	21 (42)	33 (60)	0.69
Male <i>n</i> (%)	29 (58)	22 (40)	
Comorbidity			
Type 2 DM <i>n</i> (%)	15 (30)	12 (21.8)	0.614
HT <i>n</i> (%)	11(22)	16 (29.1)	0.446
OSA <i>n</i> (%)	7 (14)	4 (7.3)	0.283
CAD <i>n</i> (%)	2 (4)	3 (5.5)	0.591

SD: Standard Deviation, **LA:** Laparoscopic appendectomy, **OA:** Open appendectomy, **DM:** Diabetes mellitus, **HT:** Hypertension, **OSA:** obstructive sleep apnea, **CAD:** coronary artery disease, **BMI:** Body Mass Index.

Table (2): Operative time, length of hospital stay and postoperative complications

	Group A (LA) n=50	Group B (OA) n=55	p value
Operative Time [min] (mean \pmSD)	59.49 \pm 12.23	68.47 \pm 16.41	<0.001
Length of Hospital Stay (mean \pmSD)	2.68 \pm 1.89	5.66 \pm 2.29	<0.001
Complications			
sSSI n(%)	2 (4)	12 (21.8)	0.042
Intra-abdominal Abscess n (%)	3 (6)	4 (7.3)	0.791
Pneumonia n (%)	2 (4)	5 (9.1)	0.236
Total Complications n (%)	5 (10)	19 (34.5)	0.023

LA: Laparoscopic appendectomy, **OA:** Open appendectomy, **min:** minutes

DISCUSSION

Acute appendicitis is a common cause of acute abdomen all over the world, with an overall lifetime incidence of about 100-206/100,000 person in the general population (Ferris et al., 2017). In 1894, OA which was first described by Mcburney was used as a standard technique until the 1980s (Mc Burney, 1894). With the increasing usage of LA, which was first done by a gynecologist Kurt Semm in 1983, OA has been questioned (Saia et al., 2012; Semm1983). In spite of LA has some better aspects in comparison to OA, such as incidence of SSI, less postoperative pain, and short length of postoperative hospital stay, the optimal approach is still not fully established (Sauerland et al., 2010).

In the current study, it was found that the duration LA was significantly shorter than OA. This result is similar to that reported by Mason et al. (2012). It is considered that the surgeons who done

LA in this study were experienced in minimal invasive surgery, which would explain the shorter operative time in patients undergoing LA. However, since the number of studies on morbidly obese patients undergoing appendectomy is small, and most of studies done on morbidly obese patients with BMI>30 kg/m², only a limited number of studies have been reported in the literature that can illustrate this issue.

In several studies on morbidly obese patients, there is conflicting data regarding the operative time. For example, in a prospective randomized study by Clarke et al., no difference was found between operative durations LA and OA (Clarke et al., 2011). However, the relatively small number of patients included in the study limits this issue. Corneille et al. reported that the operative duration was significantly shorter in those who underwent LA in comparison to those who underwent OA (Corneille MG et al., 2007).

In this study, the length of postoperative hospital stay was shorter in patients who underwent LA. Similar results have been shown in the study reported by (Varela et al., 2008). It is believed that hospital costs should be less with shorter hospital stay; however, because of our inability to collect data on cost, we could not include data that would clarify this issue in the current study.

Regarding postoperative complications in our study, it was found that total complications were significantly lower in patients who underwent LA in comparison to those who underwent OA. In the previous studies on obese patients, same results have been documented (Mason et al., 2012; Varela et al., 2008). However, when the literature is analyzed, diverse data emerge from studies conducted in morbidly obese patients. For example, Masoomi et al. (2011) reported that complications in LA group were lower compared to OA group. In meta-analysis including seven systematic reviews, similar results were reported (Woodham et al., 2012). However, Clarke et al. (2011) reported that there is no difference between both groups regarding postoperative morbidity (semm, 1983). From the previous data there was no definite agreement on complications and the superiority of either technique in literature on obese patients. However, our study was carried out on the morbidly obese patients, and previous studies conducted on morbidly obese patients reveal that general postoperative complications in LA may be lower in comparison to OA. We believe that further studies are required to find a definite consensus on this issue.

In the current study, it was found that SSI was higher in those who managed with OA than those managed with LA. Because of the obesity is an important risk factor for SSI, it is reasonable that the rate of SSI was low in LA group, which is a minimally invasive approach (Anata and Dellinger, 2006). Varela et al (2008) reported similar results on morbidly obese patients who underwent appendectomy. However, given the negative impact of diabetes mellitus (DM) on SSI, the fact that the distribution of DM in the groups was not given in the study reported by Varela JE and his colleagues may be one of the limitations of this study. Since there is no discrepancy between both groups in terms of DM, we believe that our study may clarify the effect of the approach of appendectomy on SSI more objectively. In addition to studies in morbidly obese patients, the results in several studies on obese patients are similar to the results of our study (Corneille et al., 2007; Xiao et al., 2015). Actually, it seems that laparoscopic approach has a clear advantage in this regard.

In this study, intra-abdominal abscess was similar between the two groups. While many studies on morbidly obese patients are analogous to our study, other studies reported that patients who underwent LA have more intra-abdominal abscesses while others have less (Woodham et al., 2012; Corneille et al., 2007; Masoomi et al., 2011). Also, in this study, there was no difference between the two groups in terms of pneumonia. In general, our study revealed no difference between the two groups regarding intra-abdominal abscess and pneumonia, whereas SSI was significantly higher in those who underwent OA,

this may be explained by the fact that general complications were more common in patients who underwent OA. None of the patients included in our study needed conversion from laparoscopic to open surgery. We believe that the surgeons who did the operations were experienced in minimally invasive surgery, which may explain this point.

In this study, 18 patients were excluded due to perforation of the appendix or appendicular abscess to reduce the bias between the surgeons. Although no obligatory conversion indications were declared, a complicated case is always managed based on the surgeon's experience. However, the rate of complication and/or conversion would be influenced among the surgeon's choice. Hence, these patients were excluded in order to improve and optimize the standardization of this retrospective study.

The main limitations of our study include retrospective analysis of this study, small sample size, deficiency of operational choice determinant. Furthermore, the surgical approach is always surgeon's choice. In spite of this issue seems like a bias, the results gave us the significant differences in outcome between both approaches. In the minimal invasive surgery era we live, surgeons' choices are mostly laparoscopic for all surgical interventions. On the other hand, conventional open appendectomy is still of choice for some surgeons. The next step for us will be a prospective model of the same theme.

CONCLUSION

Based on our data, LA and OA techniques have no clear superiority over each other in obese patients. We think that the choice between two approaches

should be based on the clinical conditions and the surgeon's experience. Nevertheless, the results of the current study revealed that laparoscopic approach has some advantages in the management of acute appendicitis, as in all surgical procedures. Considering that the length of hospital stay was shorter and the risk of wound infection was lower, it should be emphasized that laparoscopic surgery might be preferred.

REFERENCES

1. Afshin, A.; Forouzanfar, M.H.; Reitsma, M.B.; Sur, P.; Estep, K.; Lee, A. et al. (2017): Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med*; 377: 13-27.
2. Anaya, D.A.; Dellinger, E.P. (2006): The obese surgical patient: a susceptible host for infection. *Surgical infections*.7 (5):473-80.
3. Clarke, T.; Katkhouda, N.; Mason, R.J.; Cheng, B.C.; Olasky, J.; Sohn, H.J.; et al. (2011): Laparoscopic versus open appendectomy for the obese patient: a subset analysis from a prospective, randomized, double-blind study. *Surgical endoscopy*.;25(4):1276-80.
4. Corneille, M.G.; Steigelman, M.B.; Myers, J.G.; Jundt, J.; Dent, D.L.; Lopez, P.P.; et al. (2007): Laparoscopic appendectomy is superior to open appendectomy in obese patients. *The American journal of surgery*.;194 (6):877-81.
5. Delaney, C.P.; Pokala, N.; Senagore, A.J.; Casillas, S.; Kiran, R.P.; Brady, K.M.; et al. (2005): Is laparoscopic colectomy applicable to patients with body mass index > 30? A case-matched comparative study with open colectomy. *Diseases of the colon & rectum*. 2005;48 (5):975-81.

6. Ferris, M.; Quan, S.; Kaplan, B.S.; Molodecky, N.; Ball, C.G.; Chernoff, G.W.; et al. (2017): The global incidence of appendicitis: a systematic review of population-based studies. *Annals of surgery*.; 266 (2):237-41.
7. Mason, R.J.; Moazzez, A.; Moroney, J.R.; Katkhouda, N. (2012): Laparoscopic vs open appendectomy in obese patients: outcomes using the American College of Surgeons National Surgical Quality Improvement Program database. *Journal of the American College of Surgeons*.; 215 (1):88-99.
8. Masoomi, H.; Nguyen, N.T.; Dolich, M.O.; Wikholm, L.; Naderi, N.; Mills, S.; et al (2011): Comparison of laparoscopic versus open appendectomy for acute nonperforated and perforated appendicitis in the obese population. *The American journal of surgery*.; 202 (6):733-9.
9. Mc Burney CH. IV. (1894): The incision made in the abdominal wall in cases of appendicitis, with a description of a new method of operating. *Annals of surgery*; 20 (1):38.
10. Noudeh, Y.J.; Sadigh, N.; Ahmadnia, A.Y. (2007): Epidemiologic features, seasonal variations and false positive rate of acute appendicitis in Shahr-e-Rey, Tehran. *International journal of surgery*;5 (2):95-8.
11. Saia, M.; Buja, A.; Baldovin, T.; Callegaro, G.; Sandona, P.; Mantoan, D.; et al.(2012): Trend, variability, and outcome of open vs. laparoscopic appendectomy based on a large administrative database. *Surgical endoscopy*. 26 (8):2353-9.
12. Sauerland, S.; Jaschinski, T.; Neugebauer, E.A. (1983): Laparoscopic versus open surgery for suspected appendicitis. *Cochrane Database of Systematic Reviews*.2010 (10).
13. Semm, K. (1983): Endoscopic appendectomy. *Endoscopy*.;15 (02):59-64.
14. Varela, J.E.; Hinojosa, M.W.; Nguyen, N.T. (2008): Laparoscopy should be the approach of choice for acute appendicitis in the morbidly obese. *The American journal of surgery*;196 (2):218-22.
15. Von Titte, S.N.; McCabe, C.J.; Ottinger, L.W. (1983): Delayed appendectomy for appendicitis: causes and consequences. *The American journal of emergency medicine*. 1996;14(7):620-2.
16. Williams, G.R. (1983): Presidential Address: a history of appendicitis. With anecdotes illustrating its importance. *Annals of surgery*. 1983;197 (5):495.
17. Woodham, B.L.; Cox, M.R.; Eslick, G.D. (2012): Evidence to support the use of laparoscopic over open appendectomy for obese individuals: a meta-analysis. *Surgical endoscopy*.;26 (9):2566-70.
18. Xiao, Y.; Shi, G.; Zhang, J.; Cao, J.G.; Liu, L.J.; Chen, T.H.; et al. (2015): Surgical site infection after laparoscopic and open appendectomy: a multicenter large consecutive cohort study. *Surgical Endoscopy*. 2015;29 (6):1384-93.

استئصال الزائدة الدودية بالمنظار مقابل الجراحة المفتوحة في مرضى السمنة المفرطة: دراسة بأثر رجعي

محمد سعيد عيسى - محمد السيد زايد

قسم الجراحه العامه - مستشفى بنها الجامعى - كلية الطب البشرى - جامعة بنها

الهدف من الدراسة: نحن نهدف من هذه الدراسة اكتشاف الطريقة الامثل لاستئصال الزائدة الدودية لمرضى السمنة المفرطة وتحديد ما اذا كانت الجراحة المفتوحة ام استئصال الزائدة الدودية بالمنظار لهذه المجموعة من المرضى

المرضى وطرق البحث: تم تحليل سجلات ٣١٤ مريضاً خضعوا لاستئصال الزائدة الدودية بسبب التهاب الزائدة الدودية الحاد بين أغسطس ٢٠١٦ وأغسطس ٢٠١٨ بأثر رجعي. كانت معايير الاستبعاد هي: أولئك الذي تقل أعمارهم عن ١٨ عاماً، ومؤشر كتلة الجسم اقل من ٤٠ كجم / م^٢، وأولئك الذين لديهم انفجار او تكثل في الزائدة الدودية. تم إشراك ١٠٥ مرضى لهذه الدراسة والذين انطبقت عليهم الشروط السابقة. تم تقسيم المرض الى مجموعتين: المجموعة أ، تضم ٥٠ مريضاً خضعوا للاستئصال بالمنظار والمجموعة ب، وتشمل ٥٥ مريضاً خضعوا للجراحة المفتوحة. تم تسجيل البيانات الاجتماعية والديموغرافية، و وقت العملية، والعدوى الجراحية السطحية الموضعية المرتبط بالجراحة، وغيرها من المضاعفات داخل البطن، والمضاعف اتغير الجراحية، وطول مدة الإقامة في المستشفى بعد الجراحة.

النتائج: لم يتم الكشف عن اختلافات ذات دلالة إحصائية بين المجموعتين من حيث العمر والجنس. ومع ذلك، وجد أن متوسط قيمة مؤشر كتلة الجسم في مجموعة الاستئصال بالمنظار أعلى بكثير. تبين أن مدة العملية وطول الإقامة في المستشفى كانت أقل بكثير أيضا في مجموعة الاستئصال بالمنظار. تم العثور على المضاعفات العامة والسطحية لتكون أقل بكثير في مجموعة الاستئصال بالمنظار

الخلاصة: على الرغم من ان اسئصال الزائدة الدودية بالمنظار لم يكن لديه ميزة واضحة على الجراحة المفتوحة في مرضى السمنة المفرطة. فانه يجب التأكيد على أن الجراحة بالمنظار قد تكون مفضلة بسبب العديد من المزايا مثل قصر مدة الإقامة في المستشفى بعد الجراحة والحد الأدنى من المخاطر والمضاعفات.

٢١. المجلة المصرية للعلوم الطبية ٣٩ (٢) ديسمبر ٢٠١٨ : ٨٨٣-٨٩٣.