Laparoscopic versus open appendicectomy in obese patients: a prospective randomized comparison

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Background
Obese patients who present with general surgical emergencies afford unique obstacles to emergency surgeons. Whereas there seems to be no absolute advantage to laparoscopy in acute appendicitis for the overall population, it has been postulated that among obese cases, the laparoscopic technique may provide more conclusive benefits.
Objectives
Because of limited data on this issue, the focus of this research was to compare the clinical outcomes of laparoscopic and open-appendicectomy techniques in obese population.
Patients and methods
A number of 64 cases of acute appendicitis with BMI more than or equal to 30 were randomly assigned to one of two groups: laparoscopic or open-appendicectomy groups. The outcomes evaluated include duration of hospital stay, operative times, postoperative complications comprising intra-abdominal abscesses and incision-site infections, time to start oral intake, and number of analgesic-dose requirements.
Results
In comparison with open appendicectomy, laparoscopic appendicectomy associated with shorter operative time *P* value of 0.042, shorter length of hospital stay (P=0.001), fewer doses of analgesia (P<0.001), and earlier toleration of oral intake (P=0.002). While there was nonsignificant difference between the groups for intraoperative complications (P=0.565) or postoperative complications (intra-abdominal or surgical-site complications) (P=0.708).
Conclusion
Laparoscopic appendectomy resulted in lower operative time, a shorter hospital stay, earlier oral intake, and a reduced need for analgesia with a complication rate that was comparable to its open counterpart, and it can be recommended as a standard procedure in obese patients with acute appendicitis.

Keywords:
appendicitis, BMI, laparoscopic appendicectomy, obese patients, open appendicectomy

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Introduction

Acute appendicitis is the commonest cause for emergent abdominal surgery all over the world [1], the advent of laparoscopic surgery has radically changed the field of surgery, with improved equipment, and expanded clinical knowledge allowed laparoscopic appendicectomy for the first time by Semm [2].

The concepts of least-surgical trauma, dramatically shorter hospital stay, minimum postoperative discomfort, rapidly return to lifestyle, and improved cosmetic results, besides the opportunity to find concurrent pathology and to detect other reasons of abdominal pain, made laparoscopic appendicectomy a very appealing procedure [3].

Global obesity has more than doubled over the last 30 years, with the world's highest adult obesity rate in Egypt [4]. Obesity has been found to have a detrimental effect on the outcomes of colorectal surgery, along with longer operating hours and increased postoperative morbidity [5], abdominal-wall bulkiness in obese cases creates an additional obstacle for open appendicectomy, and wider incision sites are used to contribute to increased postoperative pain and longer wound-healing time, both of which can extend the overall recovery time [6].

As the conflict between the two approaches continues, we conduct this research to compare the advantages and disadvantages between laparoscopic and open-surgical approaches in obese patients with BMI more than or equal to 30 undergoing appendicectomy for acute appendicitis as regards to hospital stay, operating time,

postoperative complications, analgesia requirement, and time to start oral intake.

Patients and methods

This prospective comparative randomized study was performed from August 2020 to October 2021 in Menoufiya University Hospital. The study included all patients with a BMI of more than or equal to 30 admitted through the accident and emergency department with a clinical diagnosis of acute appendicitis and those who completed follow-up. All patients included were 15 years of age or older.

Exclusion criteria

Noncompliant patients during the follow-up period, Pregnant females, previous laparotomy, Patients with BMI less than 30, coagulation disorders, and patients unfit for surgery, for example, hepatitis and uncontrolled diabetes mellitus.

The complications and benefits of both surgeries were fully explained to the patients for treatment purposes, the patients were divided into two groups: laparoscopic (LA) and open group (OA). The type of surgery (laparoscopic or open) was allocated using computer-generated random figures, which were printed on a card secured in a totally opaque envelope. Every study participant gave his written informed consent, which was authorized by the Institutional Review Board.

The following parameters were used to diagnose the patients:

(1) History of right iliac fossa pain or periumblical pain shifting to the right lower quadrant, nausea and/or vomiting, and elevated body temperature of more than 38°C.
(2) On physical examination: right iliac fossa tenderness, guarding, and rebound tenderness.
(3) Investigation: leukocytosis above 10 000 cells/ml^3 and/or leukocyte shift to the left with more than 75% neutrophils.

The approval was obtained by the hospital's local ethics committee. The patient's demographic information, operational results, analgesic doses, duration of surgery, duration of hospital stay, time to restart oral intake, and postoperative problems were all recorded on special case-record forms.

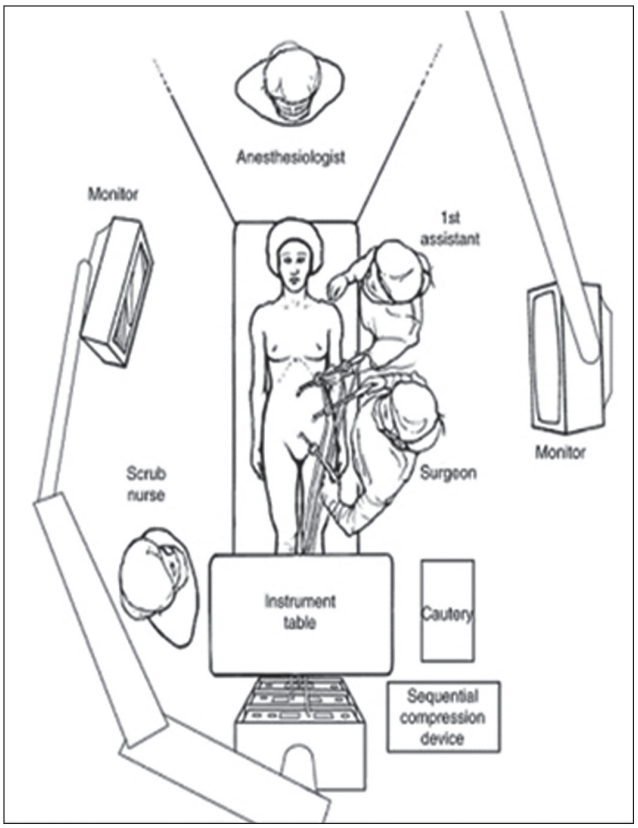
Surgical procedure

The operations were performed by staff surgeons using the same technique and rules. Laparoscopic-appendicectomy patient was positioned in a supine position with at least the left arm (or both arms) tucked along the side. A Foley catheter and elastic stockings for the lower extremities were frequently used. The abdomen was sterile-prepared and draped, exposing the whole abdomen from the epigastrium to the pubic bone, including both groins.

A pneumoperitoneum is created using a vesiport, the ports are inserted in a symmetric triangulation. A 12-mm umbilical port for laparoscope, a 10-mm port in left iliac fossa 2 cm anterior to anterior–superior iliac spine, and another 5- mm port suprapubic midline (Fig. 1).

A brief diagnostic laparoscopy is conducted after the ports are inserted to affirm the diagnosis and examine other pathologies. To facilitate exposure of the right iliac quadrant structures, the patient is situated in Trendelenberg's posture with his right side elevated. In the surgeon's left hand, a Babcock grasper is used to recede the cecum and then expose and hold the appendix. Electrocautery is used to dissect the mesoappendix (Fig. 2).

Figure 1



Trocar placement and room setup. Three ports triangulated toward the right lower quadrant are placed: a 12-mm camera port in the supraumbilical midline and 2-mm ports in the left lower quadrant and the suprapubic midline [7].

Once the appendix has been entirely skeletonized, it is secured by suture ligation using 2/0 vicryl and then is amputated at its base. If the appendix is not too huge, it is extracted through 10-mm port and withdrawn with the entire port or is placed in an impermeable retrieval bag to avoid intraperitoneal contamination and port-site incision infection. The ports are extracted and incisions closed by mattress sutures.

Open appendectomy was performed through McBurney muscle-splitting incision, once entering the peritoneal cavity, the cecum should be withdrawn using finger or a swab and the base of the appendix is identified by tracing the taenia libera (anterior taeniae coli). The appendix was encircled using Babcock and brought into wound (Fig. 3). The mesoappendix is pinched by artery forceps, then split, and ligated. An absorbable 2/0 suture was used to obtain a double ligation of the stump. The skin and fascia ware were closed by interrupted sutures in the event of a perforated appendix.

In both procedures, if the appendix appeared normal, it was resected, and the distal ileum was examined for the presence of Meckel's diverticulum and the adnexa examined for gynecological causes.

All patients received a single dose of intravenous ceftriaxone as a prophylactic antibiotic regimen at the initiation of anesthesia. If the appendix was determined to be gangrenous during surgery, two extra doses were administered of intravenous antibiotic and then shifted to oral antibiotic of amoxicillin–clavulanic for 1 week.

Laparoscopy was switched to open appendicectomy in one case with appendicular abscess that was friable with surrounding adhesions.

Postoperative course

The sounds of the intestine were monitored on a regular basis. Patients were given a clear liquid diet whenever gut sounds were detected and then progressed to the usual diet when the liquid diet was accepted and flatus was expelled. When patients well-tolerated the usual diet and were afebrile for 24 h, they were discharged.

Outcome parameters

The total operation time, duration of hospital stay, number of analgesic medications administered, and time to initiate oral intake were all recorded in a proforma. The data collector was unaware of the procedure type and documented the required injectable and oral analgesic doses. All patients were given the predefined regimen for the postoperative pain in the form of NSAIDs for 1 day, and afterward, analgesics were administered at the patient's request.

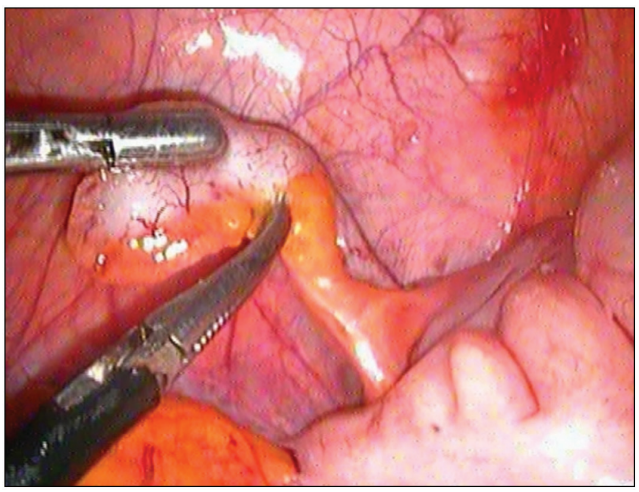
On a scale of 0 (no pain) to 10 (most agonizing pain), the patient is asked to rate his or her pain in three categories: present, least, and worst pain encountered in the previous 24 h. The patient's degree of pain was represented by the average of the three scores (Fig. 4). In the postoperative period, patients were monitored for any complications.

Follow-up

Patients were instructed to visit the outpatient clinic once a week for 2 weeks. The stitches were detached after 7 days, then patients were monitored and instructed to report any complications.

Statistical analysis was done using IBM Statistical Package for the Social Sciences (SPSS) statistics for windows, Version 23.0 (Armonk, NY: IBM Corp). The

Figure 2



Laparoscopic appendicectomy dissecting mesoappendix.

Figure 3

Gangrenous appendix in open-appendicectomy technique.

means and SDs of quantitative variables were applied to describe them. Categorical variables were compared using χ^2 and Fisher exact test when appropriate. To compare quantitative data between two groups, Mann–Whitney test (for not normally distributed data) and independent-sample *t* test (for normally distributed data) were used. The level of statistical significance was set at *P* value less than 0.05. If *P* less than or equal to 0.001, there would be a highly significant difference.

Results

The patients who participated in laparoscopic and open appendicectomy had a mean age of 27.56 and 26.38 years, respectively. Females made up 59.4% of laparoscopic cohort and 68.8% of open group. In regard to age, sex, and clinical presentation, there have been no significant demographic differences between both randomized groups (Table 1).

There is a statistically insignificant difference through the studied groups in terms of appendicular pathology (*P*=0.823). Perforated appendix represented 9.4 and 12.5% of open-appendicectomy and laparoscopic-appendicectomy patients, respectively (Table 2).

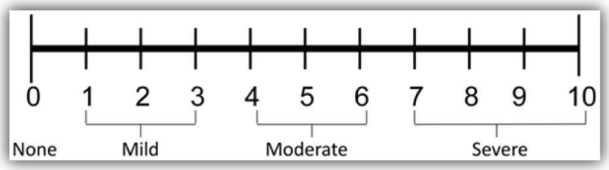
At this study, the mean surgery time for laparoscopic appendicectomy was 47.91 ± 11.19 min, which was shorter than the mean surgery time for open appendicectomy, which was 52.66 ± 10.47 min, and this result is statistically significant with *P* value of 0.042 (Table 3).

There is a statistically highly significant difference in the duration of hospital stay among the examined groups, which was significantly higher in open appendicectomy with *P* value less than 0.001. As 78.1% of laparoscopic patients stayed in the hospital for one day, compared with 42.9% of open group (Table 3).

The laparoscopic group had considerably less time to tolerate oral intake with median time that was 5 h for laparoscopic group versus 8 h within open group and *P* value of 0.002 (Table 3).

There is statistically nonsignificant variation between the studied groups regarding postoperative complications with *P* value of 0.708. Two patients within the laparoscopic group versus four within open group had wound infection, while one patient within each group had intra-abdominal abscess (Table 4).

Figure 4



The numeric pain-rating score [8].

Table 1 Characteristics of the obese patients categorized by surgical approach

	Laparoscopic (*N*=32)	Open (*N*=32)	*P* value
Age (years) (range)	27.56 (15–42)	26.38 (16–41)	0.254
Sex	40.6% male	31.3% male	0.434
Comorbidity			
Hypertension	2	3	
DM	3	3	

DM, diabetes mellitus.

Table 2 Comparison between the studied groups regarding pathological data

	Laparoscopic (*N*=32) [*n* (%)]	Open (*N*=32) [*n* (%)]	*P* value
Pathology			0.823
Normal	7 (21.9)	5 (15.6)	
Acutely inflamed	17 (53.1)	18 (56.3)	
Gangrenous	4 (12.5)	6 (18.8)	
Perforated	4 (12.5)	3 (9.4)	

Table 3 Outcomes' summary

	Laparoscopic	Open	*P* value
Operative time	47.91 (30–80) min	52.66 (40–75) min	0.042
Time to start oral intake	5 (3–48 h)	8 (4–72 h)	0.002
Total analgesic doses	2.5 (1–6)	5 (2–10)	0.001
Length of hospital stay	1 (1–3 days)	1.75 (1–5 days)	0.001

Table 4 Complications among the obese patients categorized by surgical approach

	Laparoscopic (*N*=32) [*n* (%)]	Open (*N*=32) [*n* (%)]	
Wound infection	2 (6.3)	4 (3.1)	0.672
Intra-abdominal mass	1 (3.1)	1 (3.1)	>0.999

Discussion

Obesity is a common medical issue around the world, thus affecting a large number of appendicectomy cases. The greater abdominal-wall bulkiness offers an extra technical obstacle throughout open-surgical appendicectomy, restricting hand motions and the field of vision, so according to practical experienced evidence, laparoscopic appendicectomy ought to be the adopted technique in obese individuals [9].

Surgical time was seen as a defining feature of the surgical procedure's technical difficulty. Drawing on statistics from the authors [10–12], Markar *et al.* [6] assessed surgical time and found no significant variance between open and laparoscopic appendectomy in a published meta-analysis. Instead, Ciarrocchi and Amicucci [9] found that the laparoscopic-appendectomy cohort showed a considerable reduction in operative time. This is comparable to our study that demonstrated a significant decrease of operative time in the laparoscopic cohort with *P* value of 0.042.

Our study found that the laparoscopic group had a significantly shorter hospital stay. As 78.1% of laparoscopic patients stayed in the hospital for one day, compared with 42.9% of open patients. Our findings are consistent with other publications and recent studies [5,6,13] that show a significantly shorter hospitalization in laparoscopy. While Enochsson *et al.* and Ricca *et al.* [12,14] disclosed that there was no difference in the duration of hospital stay between open and laparoscopic groups.

A quantitative way of evaluating postoperative intensity of pain in a variety of surgeries is the total analgesic requirements. To measure the analgesic needs of the two groups, the severity of postoperative pain was quantified by counting the analgesic requirements on a daily basis. Total analgesic doses were considerably fewer in the laparoscopic appendectomy with *P* value < 0.001. Our findings are coordinated with the findings of other studies [12,15] that show less agony and fewer analgesic needs in laparoscopy groups.

In contrast, Clarke *et al.* [11] and Ricca *et al.* [14] concluded that the intake of analgesics was equivalent in the laparoscopic and open groups for obese patients, and the difference in postoperative self-reported pain between the two groups was statistically insignificant.

Only one study in obese people compared the time to restart oral intake between two procedures. Clarke *et al.* [11] concluded that no differences in the time to resume oral diet were observed. In the current study, there was a statistically significant disparity between the studied groups as regards to resuming oral intake, which was substantially longer in the open group. The median time for the laparoscopy was 5 h versus 8 h for the open-surgical technique. This is coherent to a few papers that analyze this parameter but disregarding to obesity [16,17].

Many studies have linked laparoscopic appendectomy to a lower risk of complications compared with open appendectomy. In our trial, the incidence of complications postoperative was higher in the OA group (15.6%) than in the LA group (9.4%), but the difference was a statistically insignificant *P* value of 0.708, this was comparable to Enochsson *et al.* [12].

Various studies demonstrated that laparoscopic operations are associated with lower rates of wound complications. The use of smaller incisions and Endopouch bags (Ethicon Endo-Surgery), which avoid the touch of contaminated skin edges, are two theories explaining the decreased rate of surgical-site infection in laparoscopic surgeries [18]. Wound infection, especially in patients with comorbidities, can lengthen hospital stays, increase hospital costs, and lead to significant complications [9].

The development of an intra-abdominal abscess is a dangerous consequence and could be fatal. In our work, the incidence was equal and intra-abdominal abscesses occurred in one patient within each group, this result was similar to previous studies [6,13]. However, other trials reported a reduced rate of intra-abdominal abscess in laparoscopic appendectomy, but the difference was insignificant [5,9].

The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) has published a guideline, which reports that in an obese patient, LA is favored over OA [19]. Also, the Cochrane Center review recommends using laparoscopic approach in acute appendicitis cases, unless laparoscopy is contraindicated or not feasible, particularly in obese, young females, and employed patients [20].

Conclusion

Based on our data, appendectomy using laparoscopy is an effective and beneficial procedure that has significant advantages over open appendectomy in

obese patients, including a lesser need for postoperative analgesia, lower risk of surgical-site infection, and shorter hospitalization period, thus faster return to normal activities. Additionally, it is extremely helpful in determining an exact diagnosis in equivocal situations.

However, more strong high-powered randomized studies that consider procedural, total cost, and long-term complications are needed to reach a definite judgment on whether laparoscopic appendicectomy should be the surgery of choice in obese patients.

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Nil

Conflicts of interest
There are no conflicts of interest.

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