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Comparative Study Between Laparoscopic Versus Open Appendectomy in Obese Patients

General Surgery

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ABSTRACT

Background: One of the most prevalent reasons for emergency abdominal surgery is acute appendicitis. Surgical appendectomy, open or laparoscopic, is the preferred treatment choice. Since the emergence of the laparoscopic appendectomy, it's become an alternate approach to therapy for open appendectomy. Despite the fact that laparoscopic appendectomy (LA) is significantly more expensive than the open technique, many surgeons prefer it.

Aim of the work: To compare standard 3-port laparoscopic appendectomy to open appendectomy in patients with obesity.

Patients and methods: Our research included 40 obese patients presented to emergency department with acute appendicitis in Al-Hussein University Hospital and Damanhour Medical National Institute. Patients were randomized by closed envelope technique into 2 groups: Group I who underwent standard 3 ports laparoscopic appendectomy, and Group II who underwent open appendectomy with classical grid iron incision at McBurney point.

Results: Operative time, total analgesic doses required, time to start oral feeding, postoperative hospital stay, and time to resume usual activities were all statistically significant differences between the two groups. The laparoscopic group had a shorter operational time than the open group, used fewer total analgesic doses, started oral feeding earlier, had a shorter hospital stay, and returned to regular activities sooner than the open group.

Conclusion: Laparoscopic appendectomy is a feasible and safe technique in the treatment of acute appendicitis in patients with obesity .

Keywords: *ARM; Cancer breast; Positive axilla; Sodium diethyl ammonium hydroxide dye.*

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INTRODUCTION

In the Western world, acute appendicitis is the most prevalent cause of acute abdomen pain; hence appendectomy is one of the most common general surgical therapies.[1]

For more than a century, open appendectomy was the gold standard for treatment of people suffering acute appendicitis. However, the efficiency and superiority of the laparoscopic method versus the open method is currently being debated.[2]

In two prior meta-analyses, laparoscopic appendectomy has been proven to be better than open appendectomy in terms of lowering surgical site infection rates, hospital length of stay, and diagnosis ambiguity.[3]

Some research has claimed that laparoscopic surgery improves recovery periods to normal activities and postsurgical pain ratings, although these findings are controversial considering the subjective and patient-specific nature of both such results.[3]

Considering that worldwide obesity has more than doubled in the past thirty years, optimizing the results of one of the most frequent general surgical operations in overweight people would have a significant effect on healthcare in the future and is thus a field that requires research.[4]

Even though there seems to be no clear advantage to laparoscopy over open surgery for acute appendicitis in the overall population, it was proposed that in obese people, the laparoscopy method may provide more decisive benefits. Obese people have a thicker abdominal wall, which makes an open appendectomy more challenging. Larger incision sites are more common in these individuals, which might result in higher postsurgical pain and lengthier wound recovery durations, both of which might extend the entire time for recovery.[5]

Open surgery could also result in a lengthier stay in the hospital and a greater rate of surgical site infections in obese people. In morbidly obese individuals, laparoscopic surgery was found to be superior to open surgery for a variety of other surgical operations.[6]

Obesity can could obscure and decrease all symptoms of local acute appendicitis, causing the diagnosis to be delayed and, finally, may lead to and increase complications. Diagnostic laparoscopy could offer an accurate and early way for both a direct evaluation of the appendix as well as a scan of the abdomen cavity for other probable reasons of pain for such individuals. This procedure is usually used for women of reproductive age who have failed to receive a diagnosis from a presurgical pelvic ultrasonography or CT scan.[7]

The aim of our study was to compare standard 3-port laparoscopic appendectomy with open appendectomy in obese people in terms of feasibility and difficulties of technique, operative time, postsurgical pain, postsurgical hospital stay, postsurgical complications, postsurgical oral intake, postsurgical return to normal activity, and patient satisfaction regarding cosmesis.

PATIENTS AND METHODS

This study prospectively involved forty obese patients (BMI greater than or equal to 30) diagnosed with acute appendicitis and randomly distributed to one of two groups by a computer-generated program. This study was done at Al Hussein university hospital and Damanhour Medical National institute from 15th January to 29th December 2021.

Group 1: Included 20 individuals with acute appendicitis who were operated upon for laparoscopic appendectomy.

Group 2: Included 20 individuals with acute appendicitis who were operated upon for open appendectomy.

Inclusion criteria: All obese patients who were diagnosed as acute appendicitis with BMI ≥30 aged above 18 years old were candidate to the study after getting the informed written agreement.

Exclusion criteria: (1) Patients below the age of 18. (2) The diagnosis was proved intraoperatively and pathologically non inflammed appendix. (3) A palpable lump in the right bottom quadrant indicates either an appendicular mass or an appendicular abscess that was managed using antibiotics and probable percutaneous drainage. (4) Cirrhosis history, admission shock. (5) Uncontrolled coagulation disorders, severe cardiopulmonary disorders, and extensive previous abdominal surgery are all contraindications to laparoscopy surgery. (6) (Serious heart and/or pulmonary diseases): General anesthesia is contraindicated. (7) Due to a mental disability, the inability to provide informed consent. (8) Pregnancy.

The selected patients in both groups were subjected to:

Preoperative management

Detailed history taking:

Age, sex, BMI and previous lower abdominal surgery. Anorexia and periumbilical pain are present, followed by nausea, pain in the right iliac fossa, and vomiting. Pain migration from the periumbilical area to the right iliac fossa. Diarrhea or constipation. Fever, and dysuria or any vaginal discharge in females.

Complete physical examination:

Tenderness in the right iliac fossa. Rebound tenderness in the right iliac fossa. Rovsing sign: crossed tenderness from left iliac fossa to right iliac fossa, and psoas sign: pain in the right iliac fossa caused by hip flexion or hyperextension.

Laboratory work up: routine laboratory investigations:

Complete blood analysis, pregnancy test, complete urine analysis, liver and kidney function tests, random blood sugar, and prothrombin activity.

Alvarado score: were calculated as originally described by Alvarado A (1986): It is composed of ten points describing three symptoms, three signs and two laboratory tests.

Abdominal ultrasonography: Was done for all cases to exclude other pathology and exclude complicated appendicitis (mass or abscess) and other causes of acute abdomen.

Computed tomography (CT scan): Was done to exclude other pathology and exclude complicated appendicitis (mass or abscess) and other causes of acute abdomen if abdominal US is not helpful.

Operative technique: Two different approaches for appendectomy were applied, laparoscopic and open using grid iron incision at McBurney point or modified according to maximum point of tenderness. Both procedures were performed for the patients in this study depending on the result of the computerized generated program.

The two procedures were done: Under general anesthesia.

Prophylactic antibiotic was given at the time of induction, using intravenous 3rd generation cephalosporin and Metronidazole (500 mg) after doing sensitivity test .

Operative data that were assessed intra-operatively include :

Operative time: This was the time lapse between the first skin incision and the last skin stitch in minutes. Time was recorded from the first port insertion to the last port closure in the LA procedure, and from the skin incision to the skin closure in the OA operation.

Operative difficulties: any difficulty that faced the surgeon during the operation such as friable base of the appendix and difficulty to control bleeding .

Postoperative course and complications:

All the patients were assessed postoperatively as regards: The postoperative hospital stay length and the time required to resume normal activities.

Postoperative complications in the form of :

Early complications: Wound infection, fecal fistula, postoperative ileus, intra-abdominal abscess, as well as vascular complications. Late complications: port site hernia, incisional hernia and patient satisfaction regarding cosmosis. Postoperative pain assessment and analgesia needed: I.M. NSAIDS till resuming oral intake.

Follow up:

All the patients included in this study were subjected for monthly follow up for six months to detect postoperative complications in the form of wound infection or port site hernia and incisional hernia .

Statistical analysis:

The data was entered into a computer and statistically evaluated using the SPSS (Statistical Package for Social Science) version 26 software. The Shapiro Walk test has been performed to determine if the data has a normal distribution. Frequencies and relative percentages have been employed to represent qualitative data. The difference between qualitative variables has been calculated using the Chi-Square test ($\chi 2$). The mean and standard deviation have been employed to express quantitative data. The Student t test has been employed to calculate the difference between quantitative variables in two groups for parametric and non-parametric variables. $P < 0.05$ has been deemed to be statistically significant.

RESULTS

Variable		Group 1 n= 20	Group 2 n=20	P value
Age				
Mean± SD		36.0± 9.9	33.4± 8.4	0.359
BMI				
Mean± SD		34.3± 2.5	35.1± 2.9	0.364
Gender	Male n (%)	9 (45)	10 (50)	>0.999
	Female n (%)	11 (55)	10 (50)	

Table 1: Data on the two study groups' socio-demographics

The mean age was 36± 9.9 among group 1 and 33.4± 8.4 among group 2. There were no statistically significant differences between the two analyzed groups concerning age. The average BMI was 34.3 ± 2.5 among group 1 and 35.1 ± 2.9 among group 2. There were no statistically significant differences between the two analyzed groups concerning BMI. There were 45% men and 55% women among group 1, while there were 50% men and 50% women among group 2. There were no statistically significant differences between the two analyzed groups concerning sex (Table 1).

Variable	Group 1		Group 2		P value
	n	%	n	%	
Radiological confirmation of acute appendicitis					
Yes	5	25	11	55	0.053
No	15	75	9	45	
Difficulties of technique:					
Yes	4	20	11	55	0.022
No	16	80	9	45	

Table 2: Radiological confirmation of acute appendicitis and difficulties of technique among the two studied groups.

There were 25% and 55% of the cases confirmed as acute appendicitis among groups 1 and 2, respectively. There were 75% and 45% of the cases weren't confirmed radiologically as acute appendicitis among groups 1 and 2, respectively. There were no statistically significant differences between the two analyzed groups concerning radiological confirmation. There were statistically significant differences between the two analyzed groups concerning feasibility and difficulties of technique. Group 1 was significantly less than group 2 regarding the difficulties of technique (Table 2).

Variable	Group 1 Mean± SD	Group 2 Mean± SD	P value
Operation time (minutes)	72.5± 31.4	110.0± 29.6	<0.001*
Analgesic dose (IM)	8.6± 4.3	12.8± 5.8	0.012*
Hospital staying (days)	3.7± 2.0	6.9± 1.8	<0.001*
Time to oral intake (days)	1.6± 0.7	2.2± 0.8	0.017*

Table 3: Comparison of the two groups analyzed in terms of operation time, analgesic dose, stay in hospital, and oral intake time

In terms of operation time and analgesic dose, the two groups studied differed statistically significantly. Group 1 was significantly statistically lower than group 2 regarding operation time and analgesic dose. In terms of hospital stay and time to oral intake, the two groups studied differed statistically significantly. Group 1 was significantly, statistically, less than group 2 regarding hospital staying and time to oral intake (Table 3).

	Variable	Group 1		Group 2		P value
		n	%	n	%	
	No	16	80	8	40	
Early complications	Wound infection	0	0	4	20	
	Postoperative ileus	1	5	1	5	
	Intra-abdominal abscess	1	5	2	10	
	Fecal fistula	0	0	1	5	
	Vascular complications	1	5	3	15	0.022
Late complications	Port site hernia	1	5	0	0	
	Incisional hernia	0	0	1	5	

Table 4: Postoperative complications among the two studied groups.

In terms of post-operative complications, the two groups studied differed statistically significantly. Group 1 was significantly less than group 2 regarding post-operative complications (Table 4).

Variable	Group 1		Group 2		P value
	n	%	n	%	
Yes	16	80	6	30	
No	4	20	14	70	0.004*

Table 5: Satisfaction among the two studied groups.

In terms of satisfaction, the two groups examined differed statistically significantly. Group 1 was significantly higher than group 2 regarding satisfaction of the participants regarding cosmoses (Table 5).

DISCUSSION

In our study, we looked at socio-demographic data from the two groups that were analyzed. Group 1 had a mean age of 36± 9.9 years and Group 2 had a mean age of 33.4± 8.4 years. There were no statistically significant differences between the two analyzed groups concerning age. The mean BMI was 34.3 ± 2.5 in group 1 and 35.1 ± 2.9 in group 2. There were no statistically significant differences between the two analyzed groups concerning BMI. There had been 45% men and 55% women among group 1, while there had been 50% men and 50% women among group 2. There were no statistically significant differences in gender, comorbidities, or pre-operative data between the two groups analyzed.

Obesity is linked to a number of physiological alterations that can affect a patient's ability to respond to surgery, including heart, pulmonary, and immune system impairment. Obesity was linked to a higher risk of complications and technical challenges after and during operating procedures in the adult surgical population, which is unsurprising. Obese appendectomy patients present a particular challenge for the surgeon in getting access to the abdominal cavity.[8]

Regarding radiological confirmation of acute appendicitis among the two studied groups, there were 25% and 55% of the cases confirmed as acute appendicitis among groups 1 and 2, respectively. There were 75% and 45% of the cases that weren't confirmed radiologically as acute appendicitis among groups 1 and 2, respectively. Regarding radiological confirmation, there have been no statistically significant differences between the two groups studied.

Acute appendicitis diagnosis and work-up is complicated; doctors should integrate clinical evaluation and laboratory data, as well as imaging data, to arrive at a clinical appendicitis probability. This data is then used to make therapy decisions ranging from discharge to surgical referral.

This approach is complicated by the reality that many illnesses mimic appendicitis, making a clear prognosis or ruling out of the disease difficult.

Previous studies have reported higher diagnostic accuracy for acute appendicitis in non-obese patients. Previous studies have shown that the US has a high accuracy in detecting acute appendicitis in non-obese patients. Hussain et al. [9] found that ultrasonography has significantly varied diagnostic accuracy when diagnosing acute appendicitis. Of 60 individuals who had a US of the right lower quadrant done, 30 were appropriately classified as suffering from acute appendicitis on USG, and 34 instances were ultimately confirmed, depending on histopathology. Likewise, out of 26 non-appendicitis individuals, we selected 12 normal appendices. This revealed that the sensitivity of the US scan is 88%, the specificity is

92%, the PPV is 94%, the NPV is 86%, and the total accuracy is 90%. A diameter of 7 mm or greater, along with non-compressibility of the inflamed appendix, was the most reliable appendiceal finding indicating appendicitis.

Sauvain et al.[10] concluded that the role of ultrasound in obese people having a BMI ≥25 kg/m2 and suspected acute appendicitis is unclear owing to the high rate of inconclusive results. As a result, if clinical results are inconclusive, abdominal CT scans must be used to examine suspected appendicitis in obese people. They evaluated the role of preoperative imaging in diagnosing acute appendicitis and concluded that ultrasonography was the preferred radiological evaluation in our group (68 % in BMI <25 kg/m and 52.4 % in BMI ≥25 kg/m^2). Nevertheless, it was inconclusive in 42% of obese individuals vs. 6% of individuals with a BMI < 25 ($p < 0.0001$). This difference was especially noticeable among female patients (8% of inconclusive US for BMI <25 kg/m^2 versus 52% for BMI ≥25 kg/m^2, $p < 0.0001$). Individuals who were overweight had significantly more CT scans done (37 % versus 20 %; p <0.0001). BMI has no effect on CT accuracy (85 % versus 88 %; $p = 0.76$). Presurgical radiological imaging did not cause surgery to be delayed appreciably. With a total rate of conversion of 4%, laparoscopic was the preferred option for both groups (98.2 % versus 98.7 %, P = 0.86). A negative appendectomy was performed in 10% of cases.

In our study, as regarding difficulties of technique among the two studied groups, there were statistically significant differences between the two analyzed groups concerning feasibility and difficulties of technique. Group 1 was significantly less than group 2 regarding the difficulties of technique

Laparoscopic appendectomy had many benefits, in the study of Tan-Tam et al.[11], they reported that LAs have a lower length of stay (LOS) than OAs (2.06 versus 4.13 days, P < .05). In obese individuals, the LOS with LAs is considerably lower than with OAs (1.69 versus 6.82 days,P < .05). In obese individuals, LOS variability is considerably larger than in non-obese individuals (SD = 8.57 versus 2.67). A significant difference in LOS is caused by the BMI and the kind of operation.

In concordance with our results, an Ovid Literature Search employing the search terms "laparoscopic surgery and obesity" generated 758 results. Nevertheless, the majority of the publications reviewed evaluated surgical problems and results in bariatric operations and robot-assisted laparoscopic radical prostatectomy, particularly in elderly males with medical comorbidities. Only a few of the studies we looked at were pertinent to our younger female patients having elective laparoscopic gynecological operations. When compared to obese people having undergone laparotomy, the current literature endorses laparoscopic surgery over open surgery in the obese population because of the reduced postsurgical stay in the hospital, postsurgical pain, and wound infection rates, which also lower postsurgical ileus and fever.[12]

In our study, regarding the comparison between the two studied groups concerning surgery time and analgesic dose, there were statistically significant differences between the two studied groups concerning operation time and analgesic dose. Group 1 was significantly, statistically, lower than group 2 regarding operation time and analgesic dose. Furthermore, there were statistically significant differences between the two study groups in terms of hospital stay and time to oral intake. Group 1 was significantly, statistically, shorter than group 2 regarding hospital stay and time to oral intake.

This is concordant with Tan-Tam et al.[11], who reported shorter operation time in laparoscopic appendectomies done in obese patients in comparison to open method. Also, Di Saverio et al.[13] reported that in the laparoscopic appendectomy group, there was a reduced need for analgesics and a quicker return to everyday activities (16.1 ± 3.3 in OA and11.5 ± 3.1 days in LA). However, the open group's operating time was much lower (54.9 ± 14.2 in LA vs. 31.36 ± 11.13 min in OA). This may be due to surgeons' lack of experience with the laparoscopic method, which may have led to the operation's lengthier duration in their research. However, they concluded that the laparoscopic method of appendectomy is an efficient and safe operative process that offers clinically useful benefits over the open method (such as shorter stays in hospital, reduced necessity for postsurgical analgesia, earlier return to work, early food tolerance, and a lower rate of wound infection) versus only slightly higher hospital expenditures.

Tan-Tam et al.[11] performed a systemic review on 485 people, analyzing data from 315 of them (82 open appendectomies (OAs) and 233 laparoscopic appendectomies (LAs)). Obesity was diagnosed in 49 of the participants involved in the study (32 LAs and 17 OAs). The researchers discovered a significant decrease in LOS for all individuals who undergo LAs (2.44 versus 4.13 days, P = 0.05) in their data. Obese individuals had the highest significant difference in LOS (1.69 versus 6.82 days, P =0.05). According to the researchers, there was also no difference in the formation of postsurgical intra-abdominal abscesses between individuals who had LAs and those who had OAs. The researchers' findings are consistent with the findings of Varela et al.14, who conducted the largest study to date comparing the results of LAs with OAs in obese people using administrative data from 135 American academic hospitals (906 LAs versus 1,037 OAs). In this research, Varela et al.[14] discovered a decrease in LOS, general complications, such as wound infections, and average expenses in favor of LAs.

In our study, postoperative complications were among the two studied groups. There were statistically significant differences between the two analyzed groups concerning post- operative complications. Group 1 was significantly less than group 2 regarding post-operative complications.

Garg et al.[15] investigated the effectiveness of laparoscopy in complex appendicitis and found that it is safe and feasible to do laparoscopic appendectomy for complicated appendicitis. When compared to individuals who had an open appendectomy, it is

linked to lower postsurgical pain, a lower risk of infection complications, and a shorter hospital stay.

Regarding outcome, there were statistically significant differences between the two studied groups regarding satisfaction. In terms of participant satisfaction with cosmoses, Group 1 was significantly higher than Group 2.

These results were concordant with previous mentioned studies regarding comparisons between both studied techniques. Ciarrocchi et al.[16] concluded that, laparoscopic method appeared to show relevant advantages and better outcomes.

Both Masoomi et al.[17] and Clarke et al.[18] also presented findings for aggregated and risk-adjusted results in terms of demographics and comorbidities. After stratifying individuals as per rising BMI in either aggregate or matching groups, indications of preferring laparoscopic appendectomy became increasingly obvious.

From all the aforementioned data, we can conclude that the laparoscopic method ought to be the preferred technique for dealing with acute appendicitis in obese patients, with better outcomes, fewer hospital stays, and fewer complications.

CONCLUSION

Laparoscopic appendectomy is a feasible and safe technique in the management of acute appendicitis in obese people. Laparoscopy improves diagnostic ability and excludes other causes of abdominal pain.

Laparoscopic appendectomy outperforms open appendectomy in the reduction of the rate of wound infection, the reduction of postoperative pain and analgesic requirements, and the reduction of postoperative hospital stay.

Patients in laparoscopic appendectomy start oral feeding earlier than the open technique. Also, it decreases the possibility of postoperative ileus. Laparoscopic appendectomy has less operative time comparison with open appendectomy. Laparoscopic appendectomy is significantly better in cosmosis than open appendectomy.

Conflict of interest : none

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