

## LAPAROSCOPIC VERSUS OPEN APPENDECTOMY FOR ACUTE APPENDICITIS

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### Abstract

Acute appendicitis is still considered the most common cause of acute abdomen in young adult age group. Appendectomy is the most frequent urgent abdominal operation and often is the 1st major procedure performed by surgeons in training. This study aimed to find whether laparoscopic appendectomy is superior to open approach or not.

This study was done in Al-Mawanee General Hospital in Basrah, Iraq. One hundred and sixty seven patients were randomized into open appendectomy group (OA) and laparoscopic appendectomy group (LA). Different parameters were studied to find which approach is the best. The study showed longer operative time in the LA group, while there was no significant difference regarding the hospital stay, post-operative pain and post-operative complication.

In conclusion, laparoscopic appendectomy is not found to be superior to open appendectomy as there was no clear significant difference between them regarding the parameters used in this study.

### Introduction

Acute appendicitis is still the most frequent cause of acute abdomen in young adults. It is common that appendectomy is the most everyday urgent abdominal operation and often is the commonest procedure performed by junior surgeons<sup>1</sup>.

Appendix was not identified as an organ capable of causing a disease until 19th century. In 1824, Louyer-Villermay reported two autopsy cases of appendicitis. At that time, initial surgical therapy for appendicitis was primarily designed to drain right lower quadrant abscess that occurred secondary to appendicular perforation. The 1st published description of appendectomy was reported by Kronlein in 1886. In 1889, Charles McBurney published a paper in which he described the McBurney point as following "maximum tenderness, when one examines with the fingertips. It is, in adults, one and a half to

two inches medial to the right anterior superior iliac spine on a line drawn to the umbilicus". He subsequently published a paper in 1894 describing the incision that carried his name<sup>2</sup>. Addiss and associates estimated the incidence of acute appendicitis to be 11 cases/10000. Youth is a risk factor as nearly 70% of patients with acute appendicitis are younger than 30 years. Patients at extreme of age are more likely to develop perforated appendicitis<sup>3</sup>. Appendicitis has long been a surgically treated disease. However, a rare description of nonsurgical management dots the surgical literature. Treves advocated early non-operative management of acute appendicitis, even prior to the advent of antibiotic<sup>4</sup>. Based on higher rate of failure with antibiotic alone, non-operative management of acute appendicitis has not been recommended. Nevertheless, antibiotic treatment may be a useful temporizing measure in

environments with no surgical capabilities such as in the space or submarine<sup>5</sup>.

For many decades the usually considered gold standard surgical treatment for acute appendicitis has been the open appendectomy. However, in 1983, Semm introduced the laparoscopic appendectomy, which has since becomes increasingly popular<sup>6</sup>. Laparoscopic appendectomy has struggled to prove its superiority over the open technique<sup>7</sup>.

Laparoscopic surgery is a less morbid procedure that usually results in uneventful postoperative recovery for many surgical procedures. The distinguishing features of laparoscopic approach over conventional approach includes shorter hospital stay, quicker return to activity, reduced postoperative pain, and better cosmetics. These potential patient's benefits coupled with superior outcomes have facilitated the adoption of laparoscopic approach in certain procedures such as cholecystectomy, making the laparoscopic approach the gold standard treatment for such conditions. However, the role of laparoscopy in appendectomy has remained controversial with no clear consensus yet<sup>8</sup>.

In the era of advanced laparoscopic approaches, this study aims to find whether the laparoscopic approach is superior to open approach as a standard surgical treatment for acute appendicitis.

### Patients & Methods

This is a randomized prospective study, done in AL-Mawanee General Hospital in the period between June 2013 and December 2014. It includes 167 patients with suspected or diagnosed acute appendicitis. Combined clinical, radiological, and biochemical assessment for acute appendicitis were done. Patients were randomized into 2 groups based on lottery method:

First group underwent open appendectomy (OA). Second group underwent laparoscopic appendectomy

(LA). Written consents were taken from patients whether to undergo open, laparoscopic, or conversion from laparoscopic to open approach.

Any patient with generalized peritonitis, complicated appendicitis like appendicular mass, pregnant female, conversion from laparoscopic to open approach, and diagnosis other than appendicitis discovered intra-operatively on both approaches were excluded from this study.

All operations were done under general anesthesia. Prophylactic dose of antibiotic (1 gm ceftriaxone) was given 1 hour prior to surgery to all patients.

For open appendectomy, all the procedures were done with grid iron incision (sometimes muscle cutting were needed). In classical appendectomy, mesoappendix was ligated by silk 0 and divided. Appendicular base was ligated by silk 0 and transected. No purse-string or drain was used, but local toilet with saline was used in case of localized abscess. Closure by layers was done.

In laparoscopic appendectomy, all patients were operated upon by the same technique. Inflation was done by verres needle, and 3 ports were introduced as follows: 10 mm port (supra-umbilical position), 10 mm port (right mid-clavicular at the level of umbilicus) and 5 mm port (midway between umbilicus and symphysis pubis). Identification of the appendix, sealing and division of the mesoappendix using the Thunderbeat technology, ligation of appendicular base using silk 0 endoloop and transection. Removal of the appendix through the 10 mm port was performed. However, in some cases, and due to large diameter of the inflamed appendix, dilatation of the port site opening in order to get the appendix out was needed.

All patients were given post-operative antibiotics (ceftriaxone vial 1gm twice daily & metronidazole I.V. three times daily for 3 days then an oral antibiotics (cefixime capsule 200mg twice daily and

metronidazole tablets 500 mg three times daily for 4 days). Nearly all patients were instructed to start oral feeding on the 1st post-operative day.

All patients were followed-up for: operative time, post-operative pain (using Numeric Rating Scale NRS), post-operative hospital stay and post-operative complications (bleeding, wound infection and intra-abdominal abscess). Follow-up period was up to 1 month, 15 patients were excluded from the study due to loss

of follow-up. All the data were analyzed statistically to compare between the resultant values of both groups using the SPSS protocol.

### Results

Of the 167 patients included in this study, 89 patients (53.29%) were males, while female patients were 78 (46.7%). Male to female ratio was 1.14:1 as shown in Table I.

**Table I: Gender distribution among the patients with acute appendicitis underwent open & laparoscopic appendectomy**

Gender	Open Appendectomy	Laparoscopic appendectomy	Total
Males	48 (55.82%)	41 (50.62%)	89 (53.29%)
Females	38 (44.18%)	40 (49.38%)	78 (46.71%)
Total	86 (100%)	81 (100%)	167 (100%)

Table II demonstrate the age distribution. It shows that the highest incidence of acute appendicitis (52.09%) is in the age

group between 15-34 years, while the least is in the older age group above 54 years where it was (20.69%).

**Table II: Age distribution among the patients with acute appendicitis underwent open & laparoscopic appendectomy**

Age Group	Open Appendectomy	Laparoscopic appendectomy	Total
15-34 years	45 (52.32%)	42 (51.85%)	87 (52.09%)
35-54 years	23 (26.75%)	22 (27.16%)	45 (26.95%)
55 + years	18 (20.93%)	17 (20.99%)	35 (20.96%)
Total	86 (100%)	81 (100%)	167 (100%)

Post-operative pain found to be more with open appendectomy (OA) in the next 6 hours postoperatively (86.63 vs 75.00) and less in the next 24 hours

postoperatively (79.04 vs 83.19) as shown in Table III. However these results and according to the p-value were not significant (as p value found to be > 0.05).

**Table III: Difference in postoperative pain between open and laparoscopic appendectomy**

Post-operative pain	Open appendectomy	Laparoscopic appendectomy	p-value
After 6 hours	86.36	75.00	0.079
After 24 hours	79.04	83.19	0.565

Table IV shows the difference in operative time and hospital stay between the open and laparoscopic appendectomy. The operative time was found to be longer in laparoscopic appendectomy (44.96 vs 30.86) and this result considered

significant. Hospital stay is shorter for laparoscopic appendectomy (20.76 vs 27.74), but this difference is not significant statistically as p value found to be  $>0.05$ .

**Table IV: Difference in operative time and hospital stay between open and laparoscopic appendectomy**

	Open appendectomy	Laparoscopic appendectomy	p-value
Operative time (minutes)	30.86±7.42	44.96±8.89	0.0001
Hospital stay (hours)	23.74±9.30	21.76±7.39	0.062

Wound infection found to be more with open appendectomy (9 vs 3) while intra-abdominal abscess found to be more in laparoscopic appendectomy (1 vs 0).

However, these results are not significant because p-value found to be greater than 0.05 as shown in Table V.

**Table V: Difference in post-operative complications between open and laparoscopic appendectomy**

Post-operative complications	Open appendectomy	Laparoscopic appendectomy	P-value
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Wound infection	9	3	0.081
Intra-abdominal abscess	0	1	0.093

### Discussion

This study showed a slightly higher incidence of acute appendicitis among males (1.14:1). The highest incidence found in the age group 15-34 years. Such an incidence is found among many studies all over the world. A study done in Sweden showed male to female ratio of 1.12:1 which is quite close to this study while in a study done in Belgium, the ratio was 0.97:1 which is quite different from this<sup>9</sup>. Actually this is due to the conditions of each study and the criteria of patients included. Beside that and once the disease has no direct sex relation, the sex ratio may differ from one society to another.

Despite the benefits earned from laparoscopic approach, this approach is still questionable in case of laparoscopic appendectomy if compared with open approach. In regard to post-operative pain, which is considered one of the golden characteristics that has made the laparoscopic approach superior to open approach, this study found that pain in 6 hours post-operatively is more with open than with laparoscopic approach. However, this difference not found to be statistically significant, this might be due to that it uses a subjective scoring system and this making pain degree and difference determination difficult to be standardized between the patients as the pain description and pain threshold is not standard for all patients. In addition to that, in most of the patients who were included in this study there was no need to extend the grid iron incision and hence the wound size was not so long (if compared with the two 10-mm port site wounds and as a result the pain which would be felt post-operatively would be relatively the same. A study done in California by katkhouda et al<sup>7</sup> had results resemble this study results as they also found no post-

operative pain difference between the two approaches.

Operative time was found to be longer with laparoscopic appendectomy (44.96±8.8 min. vs 30.86±7.42 min.) and this result found to be statically significant. This is not so far from a study done in Taipei-Taiwan by Heng-Fu Lin et al<sup>10</sup> who found the operative time of laparoscopic appendectomy longer than the open approach. This is attributed to the little experience and familiarity with this procedure if it is compared with the most popular laparoscopic procedure done in our hospitals, the laparoscopic cholecystectomy. This is clear after completing this study as there was a clear and obvious decline in the operative time with the increase in the number of operations done but unfortunately this didn't alter the overall comparison. However, in a study done by Ioannis Kehagias et al in Tokyo -Japan<sup>11</sup>, the picture was so different; there was no significant difference in operative time between the two approaches. This is explained by the level of experience of surgeons and how familial are they with the laparoscopic appendectomy.

Hospital stay also found to be shorter with laparoscopic appendectomy than would be with the open appendectomy but the difference was not significant. This might be due to that most of the cases operated upon were not complicated especially the open, making the need for keeping the patient in the hospital for more than 24 hours unnecessary. A study done by Lin et al<sup>10</sup> showed a big difference from this study with a shorter hospital stay for the laparoscopic appendectomy which was statically significant. This might be due to their study was made on complicated appendicitis (perforated) where longer

hospital stay is needed especially for open approach.

Wound infection recorded in this study founded to be more with open than with laparoscopic approach, but again this difference was not found to be of significance. In a study done by Liang et al<sup>12</sup>, they found that when the diameter of inflamed appendix is greater than 15 mm there will be 2.32 times increase in risk of wound infection than if the diameter is less than 10 mm during laparoscopic appendectomy.

Intra-abdominal abscess found only in 1 case of laparoscopic appendectomy which was of no statistical difference from open appendectomy. Long et al<sup>13</sup> recorded a high rate of intra-abdominal abscess. He recorded 6 cases out of 86 patients underwent laparoscopic appendectomy. This was due to the large number of

patients who had perforated appendicitis with generalized peritonitis and were included in their study, while such patients were excluded from this study. From the Cochrane review, patients with gangrenous appendix are at higher risk of intra-abdominal infections and should be excluded from laparoscopic approach. However, several retrospective studies shown that the risks of intra-abdominal abscesses are statically similar between laparoscopic and open groups<sup>14,15</sup>.

### Conclusion

Laparoscopic appendectomy was not found to be superior to open appendectomy as all the parameters found in this study (post-operative pain, hospital stay, post-operative complications) not enough to make the preference for laparoscopic appendectomy as seen in other laparoscopic procedures.

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