

Laparoscopic vs Open Appendectomy: Comparison on Clinical Outcome

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ABSTRACT

Aim: In the past years, studies have reported the superiority of laparoscopic appendectomy (LA) over open appendectomy (OA) in randomized studies. Hence, this prospective study was designed to evaluate the clinical outcome of LA compared to the OA.

Methods: All the patients who were diagnosed with appendicitis and visited Tikrit Teaching Hospital in the study period were included in this study. They were divided into two groups: LA and OA groups. The two groups were compared on operating time, hospital stay, the incidence of surgical site infection, and other postsurgical complications.

Results: In the present study, a total of 128 patients (who visited Tikrit Teaching Hospital in Iraq) were included. Among them, 63 were included in the LA group and 65 people were in the OA group. The only significant difference that was observed in LA and OA group was in CRP count. In the OA group, the CRP count was significantly higher compared to the LA group ($p = 0.024$). The mean operating time was almost comparable between the LA and OA group. Blood loss was higher in the OA group and the difference was statistically significant ($p = 0.038$). Even hospital stay was also shown to be statistically higher in the OA group. A significant difference was reported in the wound infection among the LA and OA groups. In the OA group, wound infection was significantly higher (10.75%) than in the LA group (3.17%). No other adverse events were reported to be statistically different.

Conclusion: Our findings revealed that LA has many advantages over OA, including a shorter hospital stay, earlier return to work, and a lower risk of wound infection.

Clinical significance: LA significantly reduces postoperative complications and improves the surgical outcome.

Keywords: Appendicitis, Hospital stay, Laparoscopic appendectomy.

World Journal of Laparoscopic Surgery (2022): 10.5005/jp-journals-10033-1484

INTRODUCTION

The most common surgical emergency encountered in any surgical unit is appendicitis. It is the most common condition requiring appendectomy. The lifetime risk of appendicitis is 6%. In the general population, acute appendicitis is reported in approximately 7–10% of people. The most commonly acute appendicitis is reported in people who are in their second or third decade of life.¹

However, it was reported that the rate of morbidity associated with open appendectomy (OA) is around 11% with an overall mortality rate of 0.3%.²

Laparoscopic appendectomy (LA) was introduced in 1983 by a German gynecologist named Kurt Semm. After the introduction of LA, it became popular. In the field of cholecystectomy, the laparoscopic approach has become the gold standard and encouraged by its success in this field even in other surgical fields; also this technique has gained popularity.³

In the past years, studies have reported the superiority of LA over OA in randomized studies.^{3,4} This technique had shown to have advantages over OA procedures in terms of lower wound infections, fewer incidences of vomiting, less pain, and also shown to be associated with reduced hospital stays and faster recovery time.^{5,6} In contrast, it was also reported that operating time is more in the LA group and is associated with higher cost.⁶ Moreover, some of the studies failed to show any higher efficacy of LA over OA.^{7,8}

The most common complication faced in the OA is the surgical site infection (SSI). This is the most common problem that increases the hospital stay and cost of the procedure. It was noted that in OA the chances of SSI are more and this significantly increases the length of the hospital stay.⁹

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How to cite this article: Khazaal AS. Laparoscopic vs Open Appendectomy: Comparison on Clinical Outcome. *World J Lap Surg* 2022;15(1):54–57.

Source of support: Nil

Conflict of interest: None

Hence, it is quite evident that, unlike other laparoscopic procedures, in appendectomy, there exists no consensus whether LA is a better option compared with OA. Further, it is also not clear if this procedure can be performed regularly for all the patients. Moreover, in developing countries like India, there are not many studies that have been done in this field.

Hence, this prospective study was designed to evaluate the clinical outcome of LA compared to the OA including the hospital stay, operating time, development of postoperative complications, and time to resume normal activity.

MATERIALS AND METHODS

This prospective study was conducted in Tikrit Teaching Hospital in Iraq, from a period between May 2019 and December 2020. At the beginning of the study ethical clearance was taken from the institutional ethics committee. All the patients who were diagnosed

with appendicitis and visited the hospital in the study period were included in this study. Patients who were presented with other chronic illnesses and required intensive care, pregnant women, and patients who were not willing were excluded from the study. At the beginning of the study, patients were informed about the study procedure and informed consent was signed. The patients were also informed about both the procedures and the risk and benefits associated with them.

After the patients were confirmed they were randomly divided into two groups, the OA group and the LA group. Each patient was assigned computer-generated numbers for treatment purposes. All the demographic data were collected using a special data format.

Surgical Procedure and Postoperative Procedure

The operations were performed under general anesthesia under the guidance of consultant experienced surgeons. All these surgeons were experienced enough to perform both the procedures and were unknown to the data-collecting procedure. For laparoscopic technique, a standardized 3-port technique was used that uses the open (Hasson) method for establishing pneumoperitoneum. Electrocautery was used for dissection of the mesoappendix. The base of the appendix was tied and then it was divided between two endo-loops with laparoscopic scissors. The specimen was retrieved inside the extraction bag.

Open appendectomy was performed in the standard fashion. After the ligation of the mesoappendix, the appendix was divided at the base followed by its removal without performing invagination. All the specimens were sent for microscopic examination. All the patients received an antibiotic regimen. In case of any technical difficulty, laparoscopic surgeries were converted into OA.

In the postoperative period, bowel sounds were monitored every 12 hours, and once the sound was clear, the patients were put on a liquid diet. After the liquid diet was tolerated, patients were put on a regular diet.

Outcome Measures

The clinical outcome measures were recorded into a prerecorded pro forma including hospital stay, operative time, blood loss, and time to resume the normal activity and diet. The postoperative pain regimen was followed in a standardized fashion including paracetamol 500 mg tablets and intramuscular doses of diclofenac sodium. The different postoperative complications were also recorded for all the patients. The patients were followed up for the next 3 months for any further complications. They were instructed to report to the outpatient department at weekly intervals for 3 months.

Statistical Analysis

The data were collected and were evaluated using SPSS software. The data were calculated as percentages and frequencies for categorical parameters. Pearson’s Chi-square test was performed for detecting the significance among continuous variables. *p* < 0.05 was taken as statistically significant.

RESULT

In the present study, a total of 128 patients were included. The demographic variables were represented in Table 1. Among them, 63 were included in the LA group and 65 people were in the OA group. In the LA group, the patients were in the age-group of

8–85.1 years with a mean age of 35 ± 15.15 years. In the OA group, the mean age was 38.5 ± 17.12 years. No significant difference was reported in the mean age of the participants (*p* = 0.12). Similarly, no statistically significant difference was reported in the number of male and female participants (*p* = 0.453).

No significant difference was reported in terms of co-morbidities also. The most common comorbidity reported in both the group was hypertension followed by COPD. The total WBC count also showed a significant difference in both the groups (*p* = 0.16).

The only significant difference that was observed in LA and OA group was in CRP count. In the OA group, the CRP count was significantly higher compared to the LA group (*p* = 0.024).

Among the study participants, 84.1% of the patients in the LA group had uncomplicated acute appendicitis, while only 61.5% in the OA group had the same. Gangrenous appendicitis was reported in 4.76% of the cases in the LA group and 9.23% of the patients in the OA group (Table 2).

Clinical Outcome and Postoperative Complications

Table 3 describes the outcome parameter of the LA and OA procedures. The mean operating time was almost comparable between the LA and OA group. In the OA group, the operating time was 64 minutes and when compared to the LA group it was 61.5 minutes. Further analysis revealed no such statistically significant difference in the operating time. Blood loss was higher in the OA group and the difference was statistically significant (*p* = 0.038). Even hospital stay was also shown to be statistically higher in the OA group (average 7 days).

Patients who had undergone OA took more time to get back to their normal activities (15 ± 3.1). On the other hand, patients who underwent LA took less time to resume normal activity (12 ± 2.3).

Table 1: The characteristics of the patients before surgery according to the procedure

	LA (N = 63)	OA (N = 65)	<i>p</i> value
Age (years)	35 ± 15.15 (8–85.1)	38.5 ± 17.12 (7–86.5)	0.12
Gender (F/M)	40/23	45/20	0.453
CRP (mg/dL)	1.91 (0.05–26.8)	3.9 (0.03–28.3)	0.024
WBC (10 ³ /mL)	12.3 (4.3–26.5)	13.0 (4.4–36.4)	0.16
Co-morbidities, N (%)			
DM	5 (7.93%)	6 (9.23%)	
Hypertension	10 (15.87%)	12 (18.46%)	
COPD	9 (14.28%)	6 (9.23%)	

Table 2: Surgical findings, n (%)

Surgical findings, n (%)	LA (N = 63)	OA (N = 65)
Uncomplicated acute appendicitis	53 (84.1%)	40 (61.5%)
Gangrenous appendicitis	3 (4.76%)	6 (9.23%)

Table 3: The outcomes according to the procedure

	LA (N = 63)	OA (N = 65)	<i>p</i> value
Operating time (minutes)	61.5 (28–219)	64 (34–150)	0.67
Blood loss (g)	1 (1–300)	1 (1–848)	0.038*
Hospital stay (days)	5 (2–24)	7 (3–36)	<0.001*
Return to normal life (days)	12 ± 2.3	15 ± 3.1	<0.01

*Statistically significant

Table 4: Number of postoperative complications

Postoperative complication	LA (N = 63)	OA (N = 65)	p value
Surgical site infection (SSI)	2 (3.17%)	7 (10.75%)	0.002
PONV	30 (47.61%)	20 (30.76%)	0.62
Intra-abdominal abscess	1 (1.58%)	1 (1.53%)	0.15
Readmission	0	0	

Table 4 describes the postoperative complications reported in the follow-up period. A significant difference was reported in the wound infection among the LA and OA groups. In the OA group wound infection was significantly higher (10.75%) than in the LA group (3.17%). No other adverse events were reported to be statistically different.

DISCUSSION

Appendicitis is the most common condition that requires surgical intervention. Any patient presenting with an acute abdomen should always consider appendicitis, and proper diagnosis of the condition still poses a challenge.¹⁰ Laparoscopic surgeries have gained much attention in the last decade. In gall stone diseases and many other surgical procedures, the laparoscopic technique has proved to be effective and safe.¹¹

After the first report of LA was reported in 1999 in Taiwan, this technique became popular worldwide. In many of the studies, comparison of this technique with the OA was done and it was demonstrated that this technique is well tolerated.^{11–13} This technique has several advantages over the open procedures in several surgical sections being a minimally invasive surgery. It was also shown that this procedure with regard to less pain, lower recovery time, and better cosmetic appearance had some of the advantages that this technique has over the OA procedure.¹³

However, contrasting opinions are also available that have reported not many changes between the LA and OA approaches. Hence, no consensus idea exists on this topic. In this present study, the clinical outcome between the OA and LA was conducted and we hope that the study results will be able to help future researchers to conduct a large cohort study.

In the present study among the total 128 patients, 63 were included in the LA group and 65 people were in the OA group. No statistically significant difference was observed between both the groups with respect to age, gender, WBC count, and co-morbidities. However, in the level of C-reactive protein (CRP), a significant difference was observed between LA and OA patients. Patients who underwent OA had a higher level of CRP compared to the LA group. In the past, it was reported that CRP level can predict the occurrence of SSI in appendectomy cases independently.¹⁴

In the study participants, maximum of the patients had uncomplicated acute appendicitis and gangrenous appendicitis was reported in 4.76% of the cases in the LA group and 9.23% of the patients in the OA group. This is also an interesting finding as other than CRP level pathology of the condition has also shown to be associated with the SSI among appendectomy patients.¹⁴

In the present study, longer operating time was reported in the OA group. In the LA group, the operating was almost 4 minutes slower than the OA group. However, this difference was not found to be statistically significant. The operating time measured in this study is skin-to-skin time. This present study result is in accordance

with the previous studies that have reported a similar lower operating time in LA group.^{3–5}

Usually, a longer operating time in LA occurs because of the lower experience of the surgeons performing the surgeries. Two factors are usually dependent on the experience of the surgeons: blood loss and operating time. With the increased experience of the surgeon the blood loss and operating time both decrease. Even, the pathological conditions of appendicitis also dictate the amount of blood loss and operating time.¹⁵ In our study also blood loss was significantly lower in the LA group compared to the OA group.

The present study also reported a shorter hospital stay for the patients who underwent the LA procedure. Hospital stay is another factor that increases the cost of the operation and poses an economic burden on the patient. Though we did not compare the cost of both the technique, it is quite apparent that the cost will be lower in the LA group. Our result is consistent with the early studies that pointed out significant lower hospital stay in LA group.^{11,16}

Patients who had undergone OA took more time to get back to their normal activities (15 ± 3.1). On the other hand, patients who underwent the LA took less time to resume normal activity (12 ± 2.3). Our study also reported lower incidences of SSI in the LA group. In the OA group, wound infection was significantly higher (10.75%) than in the LA group (3.17%). This could be because in OA direct exposure of the wound site occurs in the procedure. Whereas, in the LA, the specimen was removed using an extraction bag. This finding also is similar to the previous finding by Shimoda et al.⁹ However, the instances of PONV were higher in the LA group. None of the group patients required readmission.

CONCLUSION

Our findings revealed that LA has many advantages over OA, including a shorter hospital stay, earlier return to work, and a lower risk of wound infection. Also, we discovered that patients in the laparoscopic group had a strong preference (during consent collection) and high satisfaction after surgery.

Clinical Significance

LA should be considered secure and similarly effective to open surgery if surgical experience and equipment are available. It could be used as the first treatment of choice in most cases of suspected appendicitis, as it significantly reduces postoperative complications and improves the surgical outcome.

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