



## Laparoscopic Versus Open Appendectomy: A Comparative Study

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### Abstract

#### Introduction:

The most popular surgical procedure performed for emergency surgery is appendectomy. Paucity of clarity on the most reasonable procedure, both open (OA) and laparoscopic (LA) methods are still performed for the appendectomy. In this study, we aimed to compare the laparoscopic method over the traditional open technique for the treatment of acute appendicitis.

#### Material & methods:

For this study, 100 consecutive patients (54 males & 46 females) with a diagnosis of suspected appendicitis, between May'21 to April'23 were assigned randomly either to LA (n = 50) or OA (n = 50). The two groups were compared for operative time, length of hospital stay, postoperative analgesia, complication rate & return to normal activity.

#### Results:

Laparoscopic appendectomy was associated with a shorter hospital stay ( $2.7 \pm 2.5$  days in LA and  $6.8 \pm 1.6$  days in OA), with a less need for analgesia and with a faster return to daily activities ( $13.2 \pm 3.5$  days in LA and  $21.3 \pm 3.5$  in OA). Total number of complications was less in the LA group with much lower incidence of wound infection (0 % vs 10 %,  $P < 0.001$ ). Operative time was significantly shorter in the open group ( $24.2 \pm 3.9$  min in OA and  $47 \pm 4.7$  in LA).

#### Conclusion:

Laparoscopic appendectomy should be preferred over the open method as it offers shorter hospital stay, reduced need for postoperative analgesia, earlier return to work, lower rate of wound infection, the only disadvantage was with the longer duration of surgery.

**Keywords:** appendectomy; laparoscopic; open; complications

### Introduction

The most popular surgical procedure performed for emergency surgery is appendectomy. Lifetime risk for appendicitis is 8.6% for males and 6.7% for females, with the highest incidence in the second decade of life. [1] Open appendectomy has been the

gold standard for treating patients with appendicitis for more than a century. [2] In 1983, Kurt Semm, a German gynaecologist, introduced the use of laparoscopic techniques with the first large scale study of laparoscopic appendectomy (LA) reported

by Pier et al in 1991. [3] Efficiency and superiority of laparoscopic approach compared to open technique is subject of much debate nowadays, there is evidence that minimal surgical trauma through laparoscopic approach resulted in significant shorter hospital stay, less post-operative pain, faster return to daily activities in several settings related gastrointestinal surgery. [4]

However, several retrospective studies, randomized trials and meta-analysis comparing laparoscopic & open appendicectomy have provided conflicting results. [5] Some of these have demonstrated better clinical outcomes with laparoscopic approach while other studies have shown marginal or non-clinical benefits and higher surgical costs. [5]

We designed the present study to compare the laparoscopic approach over the open surgery for the cases of appendicitis.

### Material & Methods

We performed a prospective non-randomized study of all patients who underwent appendicectomy at rural tertiary health care center in May'21 to April '23. After the requisite Ethical clearance from the college and the university committees, informed consent in writing was obtained separately from each study subject individual. The study included 100 patients with diagnosis of acute appendicitis obtained by clinical assessment and confirmed by laboratory blood tests and imaging (US or computed tomography) when deemed necessary. New patients presenting with features of appendicitis irrespective of age & sex were included in study. Pregnant women, patients not willing to participate in study, previous abdominal surgery & patients with delayed presentation leading to an appendicular mass, abscess, and perforation were excluded from study. According to the surgical approach performed, the patients were divided randomly into two cohorts, LA group and OA group. The patients were operated by two consultant surgeons, who had sufficient capability of performing both the procedures, under spinal as well as & general anesthesia.

Laparoscopic appendicectomy (LA) was performed through 3 port technique, 10 mm trocar insertion at infraumbilical site, and the other two 5 mm ports placed at both sides of the lower abdomen preferably just above pubic bone with carbon dioxide used to

create pneumoperitoneum. The dissection was carried out at base of appendix, the mesoappendix coagulated with bipolar forceps and divided. An endoloop was passed around the base of appendix and it was tied. The appendix was divided at the base between two endoloop. Resected appendix was retrieved through umbilical port and sent for histopathological examination.

Open appendicectomy (OA), was performed through a Mcburney's or Lanz incision. The peritoneum was accessed through muscle splitting incision and appendix was brought out and removed in the usual manner. We recorded the operative time for both the procedures starting from incision of skin up to its closure. Postoperatively, duration of analgesia was recorded, days of hospital stay, and days after which patient returned to normal work.

All quantitative data was compared by independent sample test. All qualitative data was compared by chi-square test & student t test. A p-value <0.05 was considered statistically significant & p-value <0.001 was considered highly significant. Data entered in MS excel sheet and analyzed by using SPSS IBM USA.

### Results

A total of 100 patients with a diagnosis of acute appendicitis undergone appendicectomy (50 LA & OA). Of which, 54(54%) & 46(46%) were males & females respectively (Graph 1).

Among 50 patients under LA group, majority of the cases belonged to age group of 21-30 years while on OA group maximum patient were in 11-20 years. The mean age of the patients in two groups LA & OA are 28.58 & 24.66 years with a standard deviation of 11.97 and 11.77 respectively. Abdominal pain was complained by all patients while nausea/vomiting was present in 41(82%) in LA group and 38(76%) in OA. The other complaint was fever 10(20%) in LA and 13 (26%) in OA. History of episodes of abdominal pain in right iliac fossa was seen in 30% and 18% of the patient of LA & OA group respectively. All patients presented with RIF tenderness while 3(6%) patients in LA & 13(26%) in OA group had guarding / rigidity. Laboratory parameters of patients in LA & OA group were comparable, mean total leukocyte count (TLC) of 9800 seen in LA group while 10318 seen in OA

group with a SD of 2141 and 2383 in LA & OA group respectively. (Table 1)

In our study, the mean  $\pm$  standard deviation (SD) operative time of  $47 \pm 4.7$  min for the LA group was longer than the mean operative time of  $24.2 \pm 3.9$  min for OA group ( $P < 0.0001$ ) (Table 2).

The laparoscopic group required (2.58 days) fewer doses of parenteral and oral analgesics in the post-operative periods compared with the open appendectomy (4.36 days). Again this difference was highly significant as p-value is less than 0.0001 (Graph 2).

LA group was associated with no cases of post-operative wound infection while in OA group 5 (10%) patients presented with wound infection. ( $P < 0.0001$ ) However, post-operative complications of fistula, abdominal abscess or septicemia was not found in either group.

LA group had significantly reduced duration of hospital stay with a mean of  $4 \pm 1.93$  as compared to OA group with a mean of  $6.8 \pm 1.69$  days ( $P < 0.05$ ) (Graph 3).

Return to normal work was defined as returning to preoperative levels of independency/dependency in activities of daily living. In laparoscopic group ( $13.2 \pm 3.53$ ) mean days taken to return to normal work were less as compared to open group ( $21.3 \pm 3.56$  days). Again this difference was also statistically significant ( $P < 0.001$ ) (Graph 4).

## Discussion

Laparoscopic surgery has become widely popular procedure for acute appendicitis & has gained its root even in rural health setup. The rate of performing LA has increased dramatically from 20.6% to 70.8% during 1998 to 2008. [6] In addition to the clinical benefits described in several studies, the laparoscopic approach allows a full exploration of the peritoneal cavity, thus representing an important diagnostic tool in case there is only suspicion of acute appendicitis. [7] A definitive diagnosis is obtained in 96% of patients undergoing LA compared with 72% of those undergoing open procedures. [8] Despite of the several advantages of laparoscopy, few surgeons still doubt its efficacy over open approach in terms of operative time, postoperative analgesia used, postoperative hospital stay, cost & complications. [9,

10, 11, 12, 13] thus it still remains a matter of debate and conventional approach is still used in clinical practice.

In our study, LA has taken a mean of  $47.04 \pm 4.7$  min and OA has taken a mean of  $24.2 \pm 3.9$  min ( $p < 0.001$ ) which is approximately 23 minutes more compared to OA which is comparable to the study done by Didier Mutter et al [14] in showed that median operating time for laparoscopic appendicectomy in their series was 45 minutes (range, 15 to 95 minutes), which compared favorably with those reported in the literature, which varied from 46 to 65 minutes. [8, 15, 16] The longer duration of laparoscopic surgery can be explained by the fact that LA involves additional steps of gas insufflation, trocar entry and diagnostic confirmation and technically more complex dissection in case of complicated appendicitis

Post-operative analgesics used either parenteral or oral in our study was 2.58 days for LA group while 4.36 days for OA group highlighting increase requirement in open group which was comparable with the study done by Ortega et al [17] showing, postoperative narcotic use is less after laparoscopic appendicectomy, with duration of analgesics for LA & OA is 3.7 & 4.5 respectively. Smaller incision and minimal tissue handling maybe the reason for decreased post-operative pain perception in LA.

Several trials have shown that postoperative complications in LA were significantly less compared to OA group. [15, 18, 19] M. Marzouk et al [20] showed LA improved the postoperative wound infection rate with no infection in LA group but with incidence of 7.6% in OA group, the reason behind it was that inflamed appendix was dissected without direct contact with the trocar wounds & done completely within the trocar sheath. In our study results were comparable with no cases of wound infection in LA group & 10% incidence in OA group.

In present study, duration of post-operative hospital stay was significantly low for laparoscopic group  $4 \pm 1.93$  as compared to open group  $6.8 \pm 1.69$ . The longer hospital stay in open group has also been reported by others. [15,18,19] Mc Anena et al [21] in their study on 65 patients found that mean duration of hospital stay is 02 days for LA as compared to 04 days in OA. A study by De Utpal et al [22] reported that the median length of stay was significantly

shorter after laparoscopic appendectomy (3 days versus 5 days,  $P < 0.0001$ ) than after open appendectomy.

Multiple studies have shown that patients of laparoscopic group can return to normal work earlier. [15, 23, 24] In our study, return to normal work was early for LA ( $13.2 \pm 3.53$  days) as compared to OA ( $21.3 \pm 3.56$  days), a difference of approximately of 7 days. A study done by CK Kum et al [19] in 137 patient of diagnosed appendicitis showed that, patients who underwent LA returned to full home/work activities (17 vs. 30 days,  $P < 0.01$ ) earlier than those who underwent OA. Earlier return to full activity appears to be an important benefit of laparoscopic appendectomy.

This study shows that LA is better approach for patients with appendicitis in majority of the cases but a prospective randomized study on larger population is required to establish its role in acute appendicitis. This study was not designed to assess cost issues. As LA takes longer operative time with costly equipment's requiring high maintenance and dedicated OT staff, it was evident that OA is cheaper approach than LA hence cost issues were not taken into consideration in our study.

### Conclusion

Laparoscopic appendectomy should be preferred over the open method as it offers shorter hospital stay, reduced need for postoperative analgesia, earlier return to work, lower rate of wound infection, the only disadvantage was with the longer duration of surgery.

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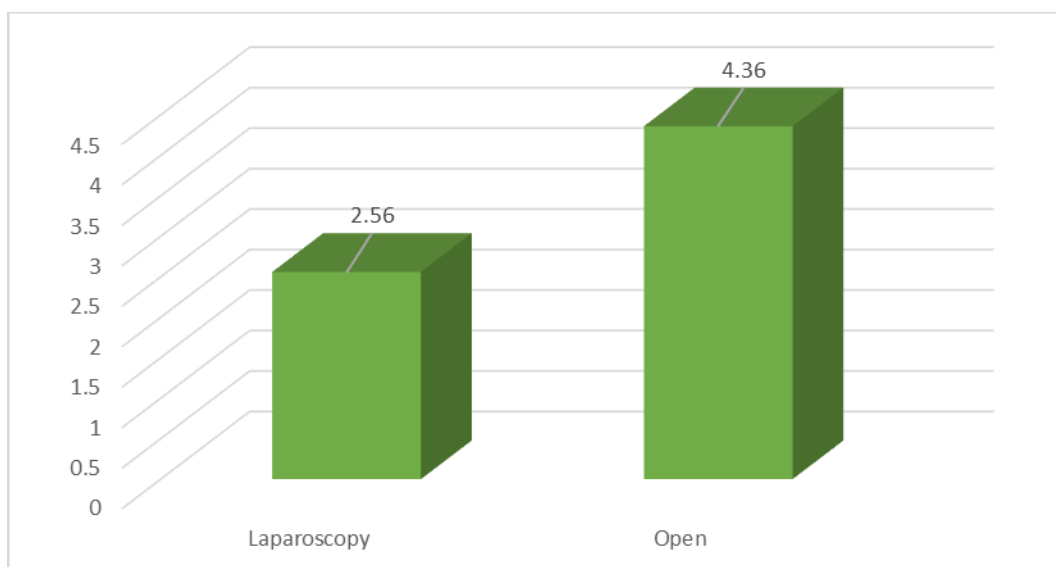
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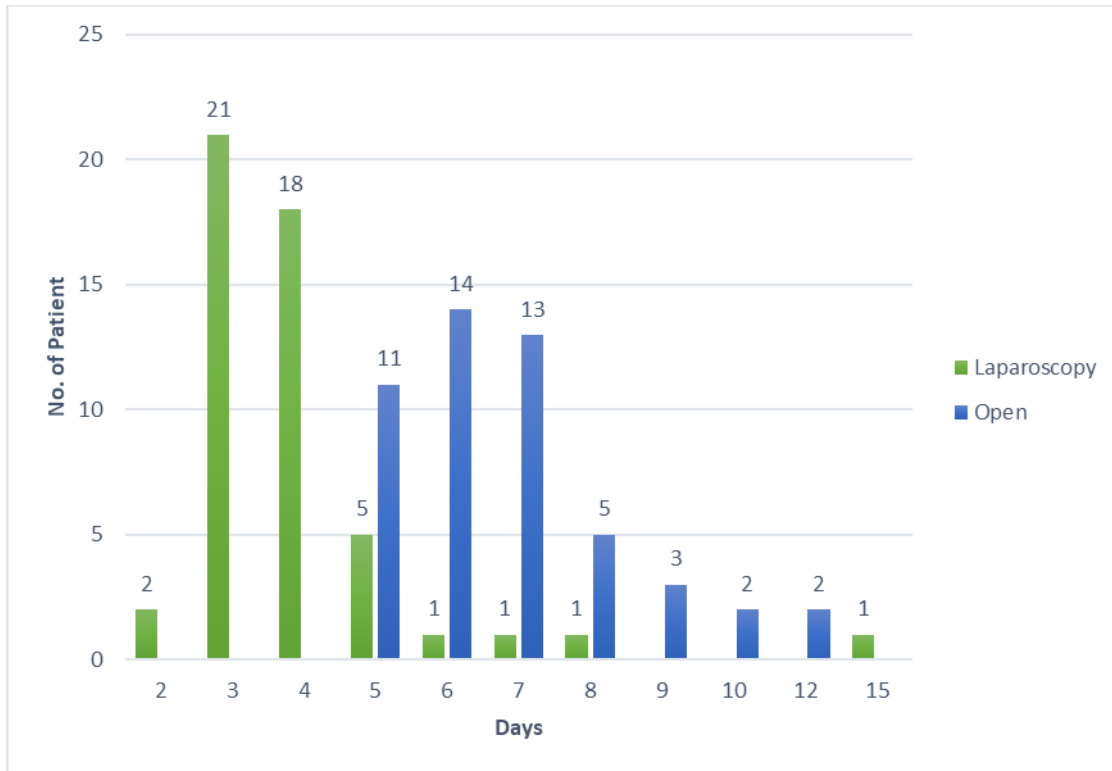
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## Tables And Graphs

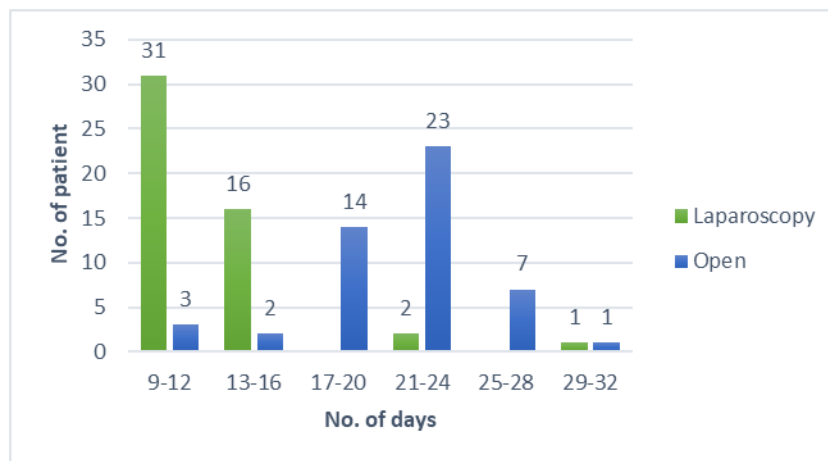
**Graph 1. Duration of analgesics used postoperatively**



**Graph 2. Post-operative stay in hospital**



**Graph 3. Post-operative time taken to return to normal work**



**Table 1. Demographic and clinical characteristics of patients**

Parameters	LA group	OA group
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Mean age	28.58±11.97	24.66±11.77
male	25	29
Female	25	21
H/O Abdo.pain	30%	18%
RIF tenderness	3(6%)	13(26%)
WBC count	9800±2141	10318±2383

**Table 2. Duration of surgery**

Minutes	Laparoscopic Appendicectomy	Open Appendicectomy
<30	0	46
30-39	0	3
40-49	32	1
50-60	18	0
<b>Mean</b>	<b>47.04</b>	<b>24.2</b>
<b>SD</b>	<b>± 4.7</b>	<b>± 3.9</b>