

## A COMPARATIVE STUDY OF OPEN VERSUS LAPAROSCOPIC APPENDECTOMY AT A TERTIARY HOSPITAL

Gudekote Ravikumara<sup>1</sup>, Vijaya Kumar<sup>2</sup>, Asha J<sup>2</sup>, S.D. Mandolkar<sup>3</sup>, Asif<sup>2</sup>

Received : 24/07/2022  
Received in revised form : 30/09/2022  
Accepted : 09/10/2022

**Keywords:**  
Appendicitis, Laparoscopic  
Appendectomy, Open  
Appendectomy, Wound Infection

Corresponding Author:  
**Dr. Asif,**  
Email: asifnaik24@gmail.com  
ORCID: 0000-0001-6012-1515

DOI: 10.47009/jamp.2022.4.5.27

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2022; 4 (5); 122-126



<sup>1</sup>Assistant Professor, Department of General Surgery, Vijayanagara Institute of Medical Sciences, Ballari, India.

<sup>2</sup>Assistant professor, Department of General Surgery, Raichur Institute of Medical sciences, Raichur, India.

<sup>4</sup>Professor & HOD, Department of General Surgery, Raichur Institute of Medical sciences, Raichur, Raichur, India.

### Abstract

**Background:** Appendicitis is the most common cause of the acute abdomen may require surgical intervention. Laparoscopic appendectomy has been shown to be both feasible and safe in comparison with open appendectomy. Present study was aimed to compare open versus laparoscopic appendectomy at a tertiary hospital. **Materials and Methods:** Present study was prospective, comparative study, conducted in patients of 18-60 years, either gender, acute and/or recurrent appendicitis, or cases who came for interval appendectomy. Patients were randomly allocated to the open appendectomy (OA) group and laparoscopic appendectomy (LA) group by computer generated numbers. **Result:** In present study, total 240 patients were studied, 120 patients from each group. Age, gender & co-morbidities were comparable & difference was not statistically significant. Mean operating time was significantly less in open appendectomy group ( $43.05 \pm 16.31$  min) as compared to laparoscopic appendectomy ( $56.64 \pm 21.02$  min) & difference was statistically significant. Mean postoperative pain (at 24 hours), measured with visual analog score was significantly more in open appendectomy group ( $4.52 \pm 1.8$ ) as compared to laparoscopic appendectomy ( $3.4 \pm 1.2$ ) & difference was statistically significant. Mean duration of post-operative ileus ( $1.09 \pm 0.6$  days vs  $0.6 \pm 0.4$  days), length of post-operative hospital stay ( $5.92 \pm 2.1$  days vs  $3.4 \pm 1.7$  days) & time taken for return to normal activity ( $7.2 \pm 2.1$  days vs  $4.7 \pm 1.9$  days) were in open appendectomy group as compared to laparoscopic appendectomy & difference was statistically significant. 1 laparoscopic procedure required conversion to pen route due to bowel perforation. Postoperative complications such as wound infection (9.17 % vs 0.83 %) was more in open appendectomy group as compared to laparoscopic appendectomy & difference was statistically significant. **Conclusion:** Laparoscopic surgical approach in managing suspected appendicitis is safe and effective as compared to open appendectomy.

## INTRODUCTION

Appendicitis is the most common cause of the acute abdomen may require surgical intervention. In acute appendicitis however, a treatment delay of even a few hours may result in stormy complication.<sup>[1]</sup> Severe complications of a ruptured appendix include widespread, painful inflammation of the inner lining of the abdominal wall and sepsis.<sup>[2]</sup>

Open appendectomy (OA) through laparotomy has been the gold standard for more than a century as far as surgical removal of appendix is concerned.<sup>[3]</sup> With the introduction of the laparoscopic technique it provided an opportunity to explore new method of

therapy in the management of the suspected cases of the acute appendicitis.<sup>[4]</sup> Laparoscopic appendectomy has been shown to be both feasible and safe in comparison with open appendectomy.<sup>[5]</sup> In addition to improved diagnostic accuracy, laparoscopic appendectomy confers advantages in terms of fewer wound infections, less pain, faster recovery and earlier return to work.<sup>[5,6]</sup>

However laparoscopic appendectomy is time consuming. It is also argued that the advantages of laparoscopic appendectomy are marginal compared to open appendectomy performed by an experienced surgeon through a short, cosmetically

acceptable incision with minimal complication and shorter hospital stay.<sup>[7,8]</sup> Laparoscopic appendectomy gives a better evaluation of the peritoneal cavity than that obtained by open approach and also facilitates other differential diagnosis.<sup>[9]</sup> Present study was aimed to compare open versus laparoscopic appendectomy at a tertiary hospital.

## MATERIALS AND METHODS

Present study was prospective, comparative study, conducted in Department of General Surgery, Raichur institute of medical sciences, Raichur, India. Study period was from Jan 2019 to March 2022. Study was approved by institutional ethical committee.

### Inclusion Criteria

- Patients of 18-60 years, either gender, acute and/or recurrent appendicitis, or cases who came for interval appendectomy, admitted under surgery department, willing to participate in present study.

### Exclusion Criteria

- Patients with systemic illness
- Pregnant patients
- Patients with appendicular mass or abscess
- Patients were medically unfit for pneumoperitoneum, unfit for general anaesthesia.
- Patients were not willing to enroll in the study

Study was explained to patients in local vernacular language & a written informed consent was taken for participation, for surgery & related risks. All patients underwent detail history-taking, clinical examination, baseline blood investigations and radiological investigations. Patients received initial conservative management, including IV fluid resuscitation with Ringer's lactate solution/Foley's

catheterization/nasogastric intubation, was done as per need.

After fitness, patients were randomly allocated to the open appendicectomy (OA) group and laparoscopic appendicectomy (LA) group by computer generated numbers. Open appendicectomy was performed either under general anesthesia or spinal anesthesia, through a muscle splitting incision in the right iliac fossa. The base of the appendix was crushed and ligated and the stump of the appendix was not invaginated.

Laparoscopic technique performed under general anesthesia using a standardized approach involving the open technique for the trocar insertion and by 3-port technique. The appendix was divided after double ligation of the base. Appendix extraction was performed using trocar sleeve to protect the wound from contamination during removal.

Both procedures were compared in relation to duration of operation, postoperative pain, postoperative hospital stay, complications, conversion rate, time taken for return to normal activity & diagnosis of additional pathologies.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

## RESULTS

In present study, total 240 patients were studied, 120 patients from each group. Age, gender & comorbidities were comparable & difference was not statistically significant.

**Table 1: General characteristics.**

Variable	Open appendicectomy (OA) (n=120)	Laparoscopic appendicectomy (LA) (n=120)	P value
Age (in years)			
Mean ± SD	35.40 ± 11.31	37.64 ± 13.02	0.62
19-30	41 (34.17 %)	38 (31.67 %)	
31-40	34 (28.33 %)	39 (32.5 %)	
41-50	31 (25.83 %)	27 (22.5 %)	
51-60	14 (11.67 %)	16 (13.33 %)	
Gender (%)			0.86
Males	71 (59.17 %)	69 (57.5 %)	
Females	49 (40.83 %)	51 (42.5 %)	
Comorbidity			0.68
Diabetes	10 (8.33 %)	11 (9.17 %)	
Hypertension	17 (14.17 %)	19 (15.83 %)	
COPD	3 (2.5 %)	1 (0.83 %)	

Mean operating time was significantly less in open appendicectomy group (43.05 ± 16.31 min) as compared to laparoscopic appendicectomy (56.64 ± 21.02 min) & difference was statistically significant.

**Table 2: Operating time**

Operating time (min)	Open appendicectomy (OA) (n=120)	Laparoscopic appendicectomy (LA) (n=120)	P value
21-40	64 (53.33 %)	36 (30 %)	< 0.001
41-60	31 (25.83 %)	49 (40.83 %)	
61-80	15 (12.5 %)	21 (17.5 %)	
>80	10 (8.33 %)	14 (11.67 %)	
Mean operating time (min)	43.05 ± 16.31	56.64 ± 21.02	

Mean postoperative pain (at 24 hours), measured with visual analog score was significantly more in open appendicectomy group (4.52 ± 1.8) as compared to laparoscopic appendicectomy (3.4 ± 1.2) & difference was statistically significant.

**Table 3: Postoperative pain (at 24 hours)**

Visual Analog Score	Open appendicectomy (OA) (n=120)	Laparoscopic appendicectomy (LA) (n=120)	P value
0-2	12 (10 %)	43 (35.83 %)	< 0.001
3-4	65 (54.17 %)	53 (44.17 %)	
5-6	29 (24.17 %)	16 (13.33 %)	
7-8	11 (9.17 %)	8 (6.67 %)	
9-10	3 (2.5 %)	0	
Mean pain score	4.52 ± 1.8	3.4 ± 1.2	

In present study, mean duration of post-operative ileus (1.09 ± 0.6 days vs 0.6 ± 0.4 days), length of post-operative hospital stay (5.92 ± 2.1 days vs 3.4 ± 1.7 days) & time taken for return to normal activity (7.2 ± 2.1 days vs 4.7 ± 1.9 days) were in open appendicectomy group as compared to laparoscopic appendicectomy & difference was statistically significant. 1 laparoscopic procedure required conversion to pen route due to bowel perforation.

**Table 4: Other characteristics**

Variables	Open appendicectomy (OA) (n=120)	Laparoscopic appendicectomy (LA) (n=120)	P value
Mean duration of post-operative ileus (in days)	1.09 ± 0.6	0.6 ± 0.4	0.001
Length of post-operative hospital stay (in days)	5.92 ± 2.1	3.4 ± 1.7	0.01
Conversion rate		1 (0.83 %)	--
Time taken for return to normal activity	7.2 ± 2.1	4.7 ± 1.9	0.001

Postoperative complications such as wound infection (9.17 % vs 0.83 %), intra-abdominal abscess (1.67 % vs 0.83 %), fever (5.83 % vs 1.67 %), post-operative ileus (5 % vs 0.83 %) & respiratory problems (1.67 % vs 0.83 %) were more in open appendicectomy group as compared to laparoscopic appendicectomy & difference was statistically significant.

**Table 5: Postoperative complications**

Complications	Open appendicectomy (OA) (n=120)	Laparoscopic appendicectomy (LA) (n=120)	P value
Wound infection	11 (9.17 %)	1 (0.83 %)	0.9477
Intra-abdominal abscess	2 (1.67 %)	1 (0.83 %)	0.5497
Fever	7 (5.83 %)	2 (1.67 %)	0.9578
Ileus	6 (5 %)	1 (0.83 %)	0.5252
Respiratory comp	2 (1.67 %)	1 (0.83 %)	-
Mortality	0	0	0.4372

## DISCUSSION

Present trend towards minimally invasive surgery has prompted general surgeons to scrutinize nearly all operations per possible conversion to laparoscopic techniques. The life time rate of appendicectomy is 12% for men and 25% in women, with approximately 7% of all people undergoing appendicectomy for acute appendicitis during their lifetime. It has been observed that males had higher rates of appendicitis than females for all age groups with an overall ratio of 1.2 to 1. [10] Singh LM11 noted that the rate of infections and overall complications (LA: 5%, OA: 11.66% were significantly lower in patients undergoing LA. The

median length of stay was significantly shorter after LA (45% discharged 2nd day) than after OA (36% discharged on 4th day). VAS score was 0-2 in 60 % cases LA and 9-10 in 00 % cases as compared to OA VAS was 0-2 in 15 % and 9-10 in 3.33% cases. LA is associated with increased clinical comfort in terms of fewer wound infections, faster recovery, earlier return to work and improved cosmesis. [11] In study by Agarwal P, [12] mean age of patients of Open appendicectomy and laparoscopic appendicectomy was 42.12±11.11 and 43.10±10.23 years respectively. Majority of patients in both Open appendicectomy (77.5%) and laparoscopic appendicectomy (80%) were males. Inflamed appendix with omental adhesions was the most common feature amongst more than half of the

patients in both open appendectomy (65%) and laparoscopic appendectomy (75%). The mean operative time was significantly ( $p=0.001$ ) lower among patients of laparoscopic appendectomy compared to open appendectomy. The mean postoperative pain and cosmesis was found to be significantly ( $p=0.001$ ) lower among patients of laparoscopic appendectomy compared to open appendectomy. Wound infection was the most common post-operative complication in both Open appendectomy (7.5%) and laparoscopic appendectomy (5%).

Hanspal S et al,<sup>[13]</sup> noted that laparoscopic appendectomy was associated with a shorter hospital stay ( $4.34\pm 1.37$  days in LA and  $5.09\pm 1.71$  days in OA,  $p<0.01$ ), with a lower post operative pain score [VAS] ( $2.93\pm 0.80$  in LA and  $4.62\pm 0.92$  in OA,  $p<0.001$ ). Operative time was shorter in the open group ( $42.70\pm 12.05$  min in OA and  $43.39\pm 16.59$  in LA). Complications were lesser in the LA group with a significantly lower incidence of wound infection (3.4% in LA and 13.2% in OA). Laparoscopic approach is safe and efficient in appendectomy and it provides clinically advantages over open method (shorter hospital stays, lower post op pain, early food tolerance, earlier return to work and lesser wound infection) against only marginally longer operative time.

Sayyad J G,<sup>[14]</sup> noted that, duration of the operation time ranged from 30-95 min in Laparoscopic appendectomy (Mean $\pm$ SD 53.3 $\pm$ 3.1) and 25 to 60 min (Mean $\pm$ SD: 31.2 $\pm$ 2.7) in Open appendectomy. Mean duration of post-operative pain was 17.48 $\pm$ 3.4 hours in Laparoscopic appendectomy and 30.54 $\pm$ 3.45 hours in Open appendectomy ( $p<0.001$ ). The mean duration of hospital was 2.03 $\pm$ 0.12 days in Laparoscopic appendectomy and 5.23 $\pm$ 0.57 days in Open appendectomy ( $p<0.05$ ).

In study by Tanmay Mehta et al,<sup>[15]</sup> 25 patients were assigned to the laparoscopic appendectomy group and 25 patients were assigned to the open appendectomy group. There were statistically significant difference noted in respect to postoperative pain (LA, 1.21  $\pm$  0.63 Vs. OA, 2.72 $\pm$ 0.87:  $P<0.001$ ) duration of analgesic used (LA, 2.2  $\pm$  1.08 Vs. OA, 6.44  $\pm$  1.84:  $P<0.001$ ) postoperative complications like vomiting [LA, 2 (8%) Vs. O.A, 7 (28%), fever [LA, 1 (4%) Vs. OA, 4 (16%), wound infection [LA, 1 (4% Vs. OA, 5 (20%), ileus (LA, 17.3  $\pm$  7.1 Vs. OA, 30.8 $\pm$ 8.9:  $P<0.001$ ) postoperative length of hospital stay (LA, 2.8 $\pm$ 1.23 Vs. OA, 7.7 $\pm$ 1.95:  $P<0.001$ ) and return to normal work (LA, 13.5 $\pm$ 2.86 Vs. OA, 20.8  $\pm$  3.21:  $P<0.01$ ). Although above mentioned advantage were at the cost of slightly increased duration of surgery (LA, 71.2  $\pm$  19.23 Vs. OA, 53.8  $\pm$  20.04:  $P<0.01$ ). Somilar findings were noted in present study.

In area where open appendectomy is preferred, mainly due to the emergency nature of disease often operated by junior staff in odd hours when

laparoscopic equipment, trained staff and supervision may not be available in all hospitals.

Some studies have established that laparoscopic appendectomy has a higher incidence of intra-abdominal abscesses and difficult applicability particularly in complicated appendicitis. Besides, the risk of organ specific injuries is considered by some authors to be higher in laparoscopic appendectomy than in open appendectomy.<sup>[16]</sup>

It is also important to mention that LA offered us new perceptions about the operative process. There is no longer necessary to perform a purse-string suture of the caecum, and the appendiceal stump can be treated only with coagulation of the mucosa and iodization, without invagination into the caecum.<sup>[17]</sup>

Critics of laparoscopic appendectomy often point to the increased cost of the surgical equipments as a major disadvantage of the laparoscopic procedure. The increase in cost is attributed to the higher cost of specialized instrumentation such as disposable trocars, laparoscopic endostaplers, metallic clips and tissue-sealing devices such as Ligasure and Harmonic scalpel and by the use of commercially available pre-tied endoloop ligature for securing the appendiceal stump.<sup>[18]</sup> Despite these concerns however the cost effectiveness for the laparoscopic appendectomy is easily realized once the decreased hospital stay and entire patient covalence period are accounted.

## CONCLUSION

Laparoscopic surgical approach in managing suspected appendicitis is safe and effective. Despite a prolonged operative time, laparoscopic appendectomy is better than open appendectomy with respect to the postoperative pain, hospital stay, early recovery, incidence of wound infection with added advantage of laparoscopic appendectomy is its improved diagnostic ability.

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