

# Laparoscopic versus Open Appendectomy: A Comparison of Primary Outcome Studies from Southern India

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## ABSTRACT

Currently, laparoscopic appendectomy is widely practiced for the management of acute appendicitis. It is not clear whether open or laparoscopic appendectomy is more appropriate. Our aim was to compare the safety and the advantages of laparoscopic versus open appendectomy in a prospective randomized study.

**Methods:** Two hundred and forty patients were randomly divided into two groups. The group A patients were subjected to laparoscopic appendectomy [LA], whereas the group B patients were subjected to open appendectomy [OA]. The demography and the primary outcome measures of the patients such as operative duration, hospital stay, post-operative pain and post operative complications were recorded and analyzed.

**Results:** There were 120 patients in group A and group B each. Of the 120 patients in group A, 6 patients were selected for open appendectomy. The operative time for LA and OA were 18-80 [49] minutes and 30-120 [72] minutes respectively. Although LA was associated with a shorter hospital stay [LA-2.5 days versus OA-4.25 days]; the postoperative complication rates were comparable between the two groups.

**Conclusion:** LA is safe and superior to OA with respect to an early discharge, lesser postoperative pain, decreased wound infection, early return to work and a better cosmetic scar.

**Key Words:** Surgery, Abdomen, LA Versus OA

## INTRODUCTION

Acute appendicitis is a common indication for abdominal surgery, with a life-time incidence of between 7 to 9 percent [1, 2]. Appendectomy is one of the operations which are most commonly performed by the general surgeons. Open appendectomy has been the gold standard for the treatment of acute appendicitis since its introduction by Charles Mc Burney in 1889 [3]. Laparoscopic appendectomy was first performed by Semm in 1983 [4]. Since then, this procedure has been widely used. In spite of its wide acceptance, there remains a continuing controversy in the literature regarding the most appropriate way of removing the inflamed appendix.

Minimal access surgery has been proved to be a useful surgical technique. The application of the recent technology and skills can now provide a better and a cheaper choice of treatment. Despite a lot of randomized trials which have compared laparoscopic and open appendectomy, the indications for laparoscopy in patients with suspected appendicitis remains controversial.

The present study was designed to compare the advantages of laparoscopic appendectomy over conventional open appendectomy, with a review of the literature.

## PATIENTS AND METHODS

This prospective study was conducted in the Department of Surgery, SNMC and HSK Hospitals, Bagalkot, from January 2008 to September 2011. Two hundred and forty consecutive patients of the age range of 12-48 years, with features which were suggestive of acute appendicitis, were included in the study. Patients with an appendicular mass, peritonitis due to perforation, abscess, previous abdominal surgery and large ventral hernia were

excluded. A detailed history of the patients was taken, and physical examination, a complete blood analysis, urine examination and ultrasound of the abdomen were routinely performed in all the cases. The patients were explained about the risks and the benefits of the two procedures and their informed consent was obtained. All the patients were randomly divided into group A [LA] and group B [OA]. Six patients of group A were selected for laparotomy and appendectomy, but because of technical problems, adhesions and missing of the appendix, they were excluded from the study. The patients were operated by two consultant surgeons who had sufficient capability of performing the two procedures, under spinal anaesthesia. General anaesthesia was reserved for the uncooperative patients.

LA was performed through a three port technique and carbon dioxide was used to create the pneumoperitoneum. The Open Hassan technique or the Verres needle were used for creating the pneumoperitoneum, followed by a 10mm trocar insertion at the sub umbilical and the other two 5mm ports were placed in both sides of the lower abdomen, preferably below the bikini line. The dissection and mobilization of the appendix were performed by using bipolar coagulation. The appendix was divided at the base between the two endloops. The retrieval of the resected appendix was performed through the umbilical port and the appendix was sent for histopathological examination. OA was performed through a McBurney or Lanz incision. The peritoneum was accessed by muscle splitting and the appendix was delivered into the wound, which was removed in the usual manner.

All the operative details were recorded. The operative time for both the procedures was noted, right from making the skin incision till the last stitch was applied. The patients were kept nil by mouth

till the return of the bowel sounds. A soft diet, followed by regular diet, was introduced when the patients tolerated the liquid diet and had passed flatus. The pain was measured qualitatively by using a visual analog scale. The length of the hospital stay was determined as the number of nights which were spent in the hospital. The patients were discharged after they resumed a regular diet, were afebrile and had good pain relief.

The post operative complications were noted in a proforma during the hospital stay and till one month [follow up visit on the 8th day]. 'Wound infection' was defined as redness or purulent or seropurulent discharge from the incision site, which was observed within 30 days postoperatively. 'Seroma' was defined as a localized collection without redness. 'Paralytic ileus' was defined as the failure of bowel sounds to return within 12 hours post operatively.

## STATISTICAL ANALYSIS

The data were analyzed by using the Statistical Package for Social Sciences. Continuous variables such as age, hospital stay, and operative time were presented as mean +/- SD, while the categorical variables such as gender and post-operative complication were expressed as frequency and percentages by using a 90% confidence interval. The Student's t-test was used to compare the means of the continuous variables, while the categorical variables were compared by using the Chi-square or the Fisher's exact test as appropriate. A probability which was equal to or less than 0.05 [ $P < 0.05$ ] was considered as significant.

## RESULTS

The comparisons of the patient's demographics and clinical features are summarized in [Table/Fig-1]. No significant statistical differences were noted in both the groups with respect to age, sex and pain duration.

The operative details and the postoperative characteristics are noted in [Table/Fig-2]. Out of 114 patients in the LA group, 28 patients had complicated appendicitis, while 32 patients in the OA group had complicated appendicitis such as perforation and gangrenous changes. The median operative time in the OA [49.2 min] group was significantly shorter [ $p < 0.0139$ ] than that in the LA [72.5 min] group, as shown in [Table/Fig-3].

The post-operative pain was qualitatively stratified into mild, moderate and severe, according to the visual analog scale (VAS). Even though the relatively early pain was more or less equal in the LA group than in the OA group, later, it was significantly less [ $p < 0.0123$ ] as compared to that in the OA group. The post operative hospital stay was 2.5+ 0.54 days in the LA group as compared to 4.25+ 0.67 days in the OA group, which was not statistically significant [ $p < 0.2510$ ]. There were no statistically significant differences in the wound infection rates in both the groups [LA-9 (7.89%) as compared to OA-14(11.6%)], but one patient in the LA group had stump appendicitis. The patient was readmitted and underwent laparotomy with appendectomy for diverticulitis. The entire specimen was sent for histopathological confirmation. Totally, three patients had negative appendicitis, of which two patients of the LA group suffered from torsion of the ovary and one patient in the OA group had Meckel's diverticulum.

## DISCUSSION

In the last two decades, LA has gained a lot of popularity around the world. Laparoscopy is the most preferred surgical procedure for gastro oesophageal reflux disease and gall bladder disease.

Similarly, the same procedure is widely applied for appendectomy. In spite of a lot of case series and a large number of randomized clinical trials over more than two decades, the benefits of LA over AP are still controversial [5,6,7]. The results of our trial clearly demonstrated the superiority of laparoscopic appendectomy over open appendectomy regarding the postoperative pain, hospital stay, the functional status and the complication rates.

An early diagnosis with prompt surgery is the preferred treatment option for preventing complications such as perforation, that can lead to an increase in the morbidity. The laparoscopic skills of experienced laparoscopic surgeons can be transferred to different operations without increasing the morbidity. Minimal invasive surgery requires different skills and technical knowledge. So, the results of many studies were influenced by the experience and technique of the surgeons.

In our study, LA could be safely performed in 95% cases, despite the fact that 23.34% of the patients had complicated appendicitis. The rate of the conversion was 5% [Table/Fig-4] and out of it, three cases had an appendicular mass, the appendix could not be identified in one case, there was technical difficulty in two cases and the results were comparable to and were less than other series [2,8, 9,10,11]. In one case of OA, a Meckel's diverticulum was found and it was removed. In this aspect, definitely LA is superior to OA because the peritoneal cavity can be completely visualized. In two cases which were selected for LA, the torsion of an ovarian cyst was found and hence, appendectomy was avoided. The high rate of misdiagnosis in females may be due to gynaecological problems and the female functional abnormalities. So, in a patient with suspected appendicitis, LA improves the diagnostic accuracy and also avoids unnecessary appendectomy [12].

The operative duration was 23 minutes longer in the LA group as compared to that in the OA group. In most of the literature, the operating time in laparoscopic appendectomy was found to be more than that in open appendectomy. The difference of the mean time ultimately depends upon the experience of the surgeon and the competence of the team. The reasons for the prolongation include the extra steps for the setup, insufflations, trocar insertion and diagnostic laparoscopy. Our study was comparable with the following series of articles with respect to the operative duration [7, 11, 13, 14] [Table/Fig-3].

The hospital stay in our study was significantly less in LA than in OA [ $>24$ hours] and this was similar to the findings of other reported series [15, 16]. Li et al's [17] meta analyses (2010) showed a lot of controversies in the hospital stay before the year 2000, but after that, it became more significant. This discrepancy may be due to the social standards, the insurance system and the health care policies. Some authors [18] argue that the appendiceal pathology was a major determinant of the length of the hospital stay. Patients with complicated appendicitis were most likely to require an extended hospital stay. An early return to full activity one week before in the LA group was observed in the study and it was comparable with the findings of other reported series [12, 19]. This was supported by the Cochrane Colorectal Cancer Group [15]. Minimal trauma and less pain following LA allowed an early recovery. Fast resumption of a normal diet in LA was another added advantage due to the minimal handling of the bowel.

We qualitatively assessed the post-operative pain by means of a VAS on the first three consecutive days and this was quantitatively assessed by the daily requirement of analgesics. The pain was significantly less in the LA group [Table/Fig-2] in our study. Meta

Serial no	Patient particular	LA	OA	P value
01	Age [years]	12-58 [23.92]	14-62[24.54]	0.124
02	Male/Female	54/60	68/52	0.091/0.064
03	Median WBC	10.234	10.870	0.178

[Table/Fig-1]: Patients Demography

	Time	LA	OA	P value
Postoperative pain		68 [59.6%]	106 [88.34%]	0.0123
	Mild	22 [32.35%]	27 [25.47%]	0.1112
	Moderate	36 [52.94%]	64 [60.37%]	0.0097
	Severe	10 [14.7%]	15 [14.15%]	0.1197
Need for analgesics		1.5+-0.5	2.5+-0.5	0.3239
Presence of bowel sounds	12hours	98 [85.9%]	60 [50%]	0.0028
	24hours	114 [100%]	96 [80%]	0.0380
	48hours	114 [100%]	120 [100%]	0.0736
Hospital stay		2.9+-0.54	4.25+- 0.67	0.2510
Complication rate		9 [ 7.89%]	14 [ 11.6%]	0.1195

[Table/Fig-2]: Comparison of Primary Out Come

Serial no	Jamy L et al 2006	Hensen et al 1996	Khalil J et al 2011	Katkhouda N et al 2005	Present study
Mean difference of operative time	20 min [80 versus 60 min]	23 min [63 versus 40 min]	16.1 min[47.54 versus 31.36 min]	20 min [80 versus 60 min]	23min[72.5 versus 49.2 min] P< 0.0139

[Table/Fig-3]: Operative Duration

Serial No	Jamy L et al 2006	Kumar B et al 2008	Lujan-Mompean JA et al 1994	Swank HA et al 2011	Present study
Percentage	7.3%	6%	6%	7%	5%

[Table/Fig-4]: Conversion Rate in LA

analyses by Li et al [17] in 2010 also supported this study, mainly due to the less invasive nature of the procedure. This study was not blinded and so the assessment of the pain may not be so accurate. Many literature searches and meta analyses showed that there was a risk of intra-abdominal abscess [17, 20, 21, 22], but we did not have any intra abdominal abscesses in our study. Kathouda et al [7], believed that mastery of the learning curve and the use of standard guide lines definitely reduced the incidence of the intra abdominal abscesses. The reduced wound infection and the post-operative paralytic ileus can be beneficial in so many ways: less pain, an early oral intake and early mobilization, all resulting ultimately in a reduced hospital stay. In our study, the post operative complications were 7.89% [9] in the LA group as compared to 11.6% [14] in the OA group. This study was comparable to other reported series [23, 24].

Our study concluded that the change in surgical approach in managing suspected appendicitis is safe and effective. Despite a prolonged operative time, LA was found to be superior to OA with respect to the postoperative pain, hospital stay, early recovery, wound infection and cosmesis. The added advantage of laparoscopic appendectomy is its improved diagnostic ability.

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