



## A cost benefit analysis of laparoscopic versus open appendicectomy.

### KEYWORDS

Laparoscopic appendicectomy (LA), Open appendicectomy (OA), Acute appendicitis.

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**ABSTRACT** Open appendicectomy is the 'gold standard' for the treatment of acute appendicitis. Laparoscopic appendicectomy (LA), though widely practiced has not gained universal approval. The aim of this study was to evaluate the advantages of laparoscopic over open appendicectomy (OA). A total of 110 cases were included in the study. Most patients presented in second-third decade of life. The mean operating time was more in LA compared to OA ( $P < 0.002$ ). Post operative pain scores in LA was less than OA at 24 hours ( $P < 0.002$ ) and at discharge ( $P < 0.009$ ). Post operative analgesic requirement was significantly lower in LA than OA cases ( $p < 0.000$ ). Post operative complications were equal in both groups. Duration of hospital stay was significantly lower for the LA than the OA cases ( $P = 0.000$ ). The total cost of hospital stay was significantly higher in LA group ( $p < 0.000$ ). The return to normal activity was earlier for the LA than the OA group ( $P < 0.000$ ). There was no mortality in either group. Overall, laparoscopic appendicectomy is better than open appendicectomy in selected patients with acute or recurrent appendicitis.

### Introduction :

Acute appendicitis is one of the commonest causes of acute abdomen encountered in surgical practice requiring emergency surgery. It has a life time risk of 6%<sup>1</sup>. In the general population it has an incidence of 86 per 100,000 population per year<sup>2</sup>. It has been observed that males had higher rates of appendicitis than females for all age groups with an overall ratio of 1.4:1<sup>3</sup>. Even though modern diagnostic facilities, surgical skill, antibiotic therapy have brought down the mortality from 50% (before 1925) to less than 1/1, 00,000 persons, still the morbidity is around 5-8% mainly due to delayed diagnosis and treatment with resultant complications<sup>4</sup>.

Laparoscopic appendicectomy combines the advantage of diagnosis and treatment in one procedure with least morbidity<sup>5</sup>. Patient is likely to have less post operative pain and to be discharged from hospital and return to activities of daily living sooner than those who have undergone an open appendicectomy<sup>6</sup>. Other advantages include decrease wound infection, better cosmesis, ability to explore the entire peritoneal cavity for diagnosis of other conditions and effective peritoneal toileting without the need for extending the incision<sup>4</sup>. Laparoscopic appendicectomy is increasingly being employed particularly in young women of child bearing age in whom the differential diagnosis of right lower quadrant pain is extensive gynecological pathology<sup>7</sup>. The modern era of laparoscopic surgery has evoked remarkable changes in the approach to surgical diseases. The trend towards minimally invasive surgery has prompted general surgeons to scrutinize nearly all surgical procedures for possibility of conversion to laparoscopic technique<sup>8</sup>.

### Materials and methods :

A total number of 110 patients admitted in Father Muller Medical College Hospital, with a clinical diagnosis of acute or recurrent appendicitis and who underwent appendicectomy

between August 2010 to July 2012 were included in the study.

### Inclusion criteria:

1. All patients diagnosed as acute appendicitis, going for appendicectomy.
2. All patients undergoing interval appendicectomy (recurrent appendicitis), patients were included in the study after obtaining consent for the same.

### Exclusion criteria:

1. Patients those converted from laparoscopic to open appendicectomy.
2. Patients with appendicular mass on table.
3. Contraindications for laparoscopic appendicectomy like ASA IV and physiologically compromised.

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 Hasson's technique for the umbilical trocar insertion and a 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.

All cases were followed in the post operative period till they were discharged and then later followed for a period of 4 weeks in the outpatient department.

The following parameters were observed during the follow up in comparison between the two procedures, 1) the duration of surgery in minutes, 2) resumption of oral diet in days, 3) post operative pain using a verbal response pain

scale from 0 to 5, 0 being no pain and 5 being the worst possible pain, 4) duration of analgesic use in number of days, 5) post operative complications like wound infection, intraabdominal abscess and peritonitis. Patients in both the study groups were discharged as soon as possible, when they were on a normal diet, afebrile for 24 hours, when fully mobilized without need for analgesics. Duration of stay after surgery in number of days, return to normal activity in days and the total cost of hospital stay was noted.

A proforma was used to collect the relevant information. Data was analyzed using the Students't test, Mann-Whitney U test, Fisher's Exact test and the chi-square test, a P value of <0.05 was considered significant.

**Results :**

A total number of 110 cases i.e. 55 cases who underwent open appendicectomy and 55 who underwent laparoscopic appendicectomy were included in the study. The age group of patients was 10-30 years with mean age of patients being 27.29 and 28.33 years in open and laparoscopic groups respectively. The most common symptom in both groups was pain abdomen (99.1%), which was followed by fever (76.4%) and vomiting (56.4%). All patients in either group who underwent surgery were within ASA grade 3. Most common being ASA grade 1.

The preoperative ultrasonography showed an inflamed appendix in 70.9 % (n= 78) cases. Of these 67.3% (n=37) were offered laparoscopic appendicectomy and 74.5% (n=41) were offered open appendicectomy.

**Operative procedure**

The mean operating time was more in laparoscopic group (73.78 minutes) as compared to open group (59.64 minutes) (p <0.002, significant).

**Postoperative hospital stay and morbidity:**

The discomfort experienced by the group who underwent laparoscopic surgery (n=55) was compared to the discomfort experienced for the group who underwent open surgery (n=55). Well accepted pain scoring system, the verbal response scale (VRS) were used to grade the pain.

On the day of surgery most of the patients who underwent laparoscopic appendicectomy experienced grade II to III pain as compared to open group who experienced grade III to IV pain ( p<0.002) and 1 patient experienced grade V pain in open group. Prior to discharge the pain experienced by both groups had decreased, now most of laparoscopic group experienced grade 0 on VRS Scale as compared to open group who experienced grade I on the same scale (p <0.009, significant). In all cases pain relief was achieved by injectable NSAIDS administered by IM route. The duration of Post operative analgesia required in the Laparoscopic Group was significantly less than the Open Group (p<0.000 significant).

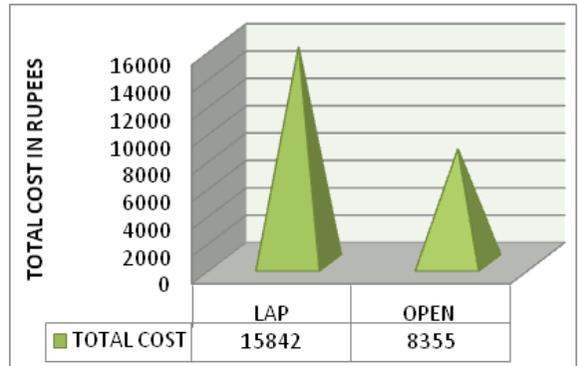
**Post Operative stay and Complications**

There were no major complications in either group. The most common complication in either group was wound infection, 12.7% in open group (n=7) as compared to 5.5% in laparoscopic group (n=3) (p is not significant). There was no mortality in either group.

The average stay for patients undergoing laparoscopic appendicectomy was 3.24 days. (range1-7 days). Patient who underwent open surgery mean duration of post operative stay was 4.38 days (range 1-9 days) (p<0.000, significant).

**Total cost of hospital stay**

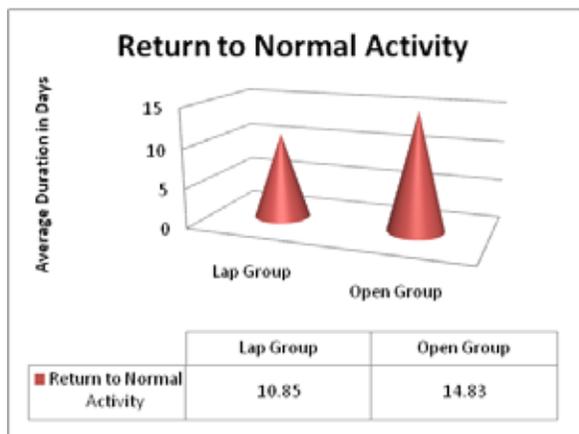
The average cost of patients undergoing Laparoscopic appendicectomy was higher as compared to the patients who underwent open appendicectomy (p<0.000, significant). (Fig 1)



**Figure 1: Total Cost of Hospital stay in Laparoscopic/Open group**

**Return to Normal activity**

The patients who underwent laparoscopic appendicectomy had an early return to normal activity as compared to the patients who underwent open appendicectomy (p is significant). (Fig 2)



**Figure-2: Duration of Return to Normal Activity Post operatively in Laparoscopic/Open Group**

**DISCUSSION**

Laparoscopy is a major surgical advance that has enabled the general surgeon to stretch his hands in the superspeciality area. The controversy that currently exists over the potential benefits of laparoscopic appendicectomy motivated us to analyze our experience with this procedure. The relative advantages and disadvantages of the laparoscopic and open appendicectomy are measured primarily in terms of duration of operation, resumption of oral diet, post operative pain and analgesic use in days. Post operative complications like wound infection, peritonitis, intrabdominal abscess, postoperative recovery in the form of postoperative duration of hospital stay and total cost during the hospital stay and return to normal activity were assessed.

In this study, the age groups (mean of 27.29 and 28.33 in the open and laparoscopy group) were comparable between the two groups. Most of the patients presented in second-third decade of life. Most common symptom of presentation in both groups was pain abdomen (99.1%), which is significant

( $p < 0.000$ ) Most of the patients in both the groups had acute presentation (69.1%), rest of them had intermittent presentation (30.9%) ( $p = 0.009$ ). In the patients who underwent surgery (lap or open) most of the patients were in ASA Grade I (93.6%). Majority of the patients in laparoscopic group, intra-operatively were adhesion free (70.9%) as compared to open group (49.1%). This was statistically significant.

There was a significant increase in the time taken for the procedure during laparoscopic appendectomy compared to the open method (mean of  $73.7 \pm 23.53$  minutes versus  $59.6 \pm 23.72$  minutes respectively). This was statistically significant ( $P < 0.002$ ). Similar results were observed in some of the studies<sup>9,10,11,12,13,14</sup>. There was a significant difference in the postoperative pain scores between open and laparoscopic appendectomy at 24 hours (3.09 vs. 2.45 respectively; ( $P < 0.000$ ) at discharge (0.47 vs. 0.73 respectively;  $P < 0.009$ ), this difference could have been because of a longer incision and stretch of the muscles. Similar observations have been reported by others<sup>9, 11, 15</sup>. The duration of postoperative analgesia required was more in the open group than the laparoscopy group ( $2.8 \pm 1.04$  versus  $1.6 \pm 0.75$  days respectively;  $p < 0.000$ ). Similar results have also been reported.<sup>16, 17,9,18,14</sup>.

The overall incidence of postoperative complications were equal in both the groups. There was a reduction in the post operative wound infection in the laparoscopy group (5.5%) as compared to the open group (12.7%). Similar results have been seen in other studies.<sup>16,19,12,20,15,21</sup>. In the present study, post operative shoulder pain was significant in the laparoscopy group ( $n=4$ ) with incidence of 7.3%,  $p=0.027$  which is significant. This possibly was due to the effect of pneumoperitoneum causing irritation of the diaphragm. There was no mortality in either group.

The requirement of IV drip was less in laparoscopic group with a mean of 1.43 days  $\pm$  0.690 and mean of 1.62 days  $\pm$  0.733 in the open group, this difference was not statistically significant ( $p=0.121$ ). Time to resume normal diet was earlier in the laparoscopy group with a mean of 1.13 days  $\pm$  0.433 and mean of 1.20 days  $\pm$  0.650 in the open group, this difference was not statistically significant ( $p = 0.576$ ). Similar studies have shown that the duration of ileus is shorter in the laparoscopy group with an early return to normal bowel function.<sup>16, 15</sup>. Dura-

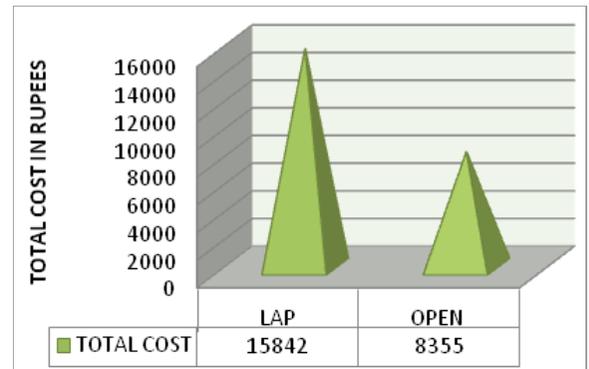
tion of hospital stay was significantly lower for the laparoscopy group (mean of 3.24 days) as compared to the open group (mean of 4.38 days) ( $P=0.000$ ). A longer hospital stay in the open group has been reported by others.<sup>16, 9, 15, 22, 18, 21</sup>. A similar study reported the median hospital stay for patients in laparoscopy group and open group were 3 days and 4 days, which were comparable.<sup>23</sup>

The total cost of hospital stay was significantly higher in laparoscopy group (mean of 15842 rupees  $\pm$  8645.02) as compared to open group (mean of 8355 rupees  $\pm$  4540.62), which is statistically significant ( $p < 0.000$ ). Similar results have been seen in other studies.<sup>24, 25, 26</sup>

The return to normal activity was earlier for the laparoscopy group  $10.85 \pm 1.45$  days, as compared to the open appendectomy  $14.83 \pm 2.29$  days. This difference being significant ( $P < 0.000$ ). Other studies have also shown similar results.<sup>9, 11, 20, 18</sup>

## CONCLUSION

On analyzing the data, we found a definite difference in the outcome between open and laparoscopic appendectomy in properly selected patients. We conclude that the laparoscopic method of appendectomy is better than the open method for acute or recurrent appendicitis, with less postoperative pain, reduced duration of analgesics used, shorter duration of hospital stay, and earlier return to normal activity, although a longer duration of surgery with a higher cost of hospital stay was involved. Overall, laparoscopic appendectomy is better than open appendectomy in selected patients with acute or recurrent appendicitis.



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