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# Comparative Study of Laparoscopic Versus Open Appendicectomy for Acute Appendicitis - A Prospective Study

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## ABSTRACT

**Background:** Acute appendicitis is the most common cause of an "acute abdomen" in young adults. Appendicectomy is the most common procedure performed in emergency surgery. There is lack of consensus for the most appropriate technique for appendicectomy. Laparoscopic appendicectomy has not become gold standard treatment for acute appendicitis unlike laparoscopic cholecystectomy for gallstone disease. The advantages of laparoscopic appendicectomy over open appendicectomy are questioned time and again. There have been many studies which concluded that laparoscopic appendicectomy is better as compared to open appendicectomy in patients of acute appendicitis in many aspects. Objective: The primary objective of this study was to compare the outcomes of laparoscopic and the open approach in the treatment of acute appendicitis. **Methods:** The study included 70 cases of appendicectomy, 35 open and 35 laparoscopic, which were randomly selected and were operated in the department of general surgery, Indira Gandhi Medical College Shimla. The following parameters were compared between the two groups: operative time, blood loss, intra-operative complications, analgesic requirement for first 48 hours, time to start ambulation, time for the bowel sounds to recover, time to start clear liquids and regular diet, wound status, discharge from the hospital (post op day), post-operative complications, time taken for return to normal activity and cosmetic outcome. Chi-square test and student t-test were used for statistical analysis. **Results:** Present study clearly proves that laparoscopic appendicectomy is better as compared to open appendicectomy in terms of post-operative pain, analgesic requirement, time to start ambulation, hospital stay, time to return to normal activity and cosmetic outcome. Laparoscopic appendicectomy was comparable to open appendicectomy in terms of operative time, time required for the bowel sounds to recover, time to start liquids and regular diet, wound infection and other complications in the present study. **Conclusion:** Laparoscopic technique in appendicectomy is safe and it clearly provides advantages over the open technique.

***Keywords:*** Acute appendicitis, Laparoscopic appendicectomy.

## INTRODUCTION

The vermiform appendix is a blind muscular tube connected to the caecum. Morphologically, it is the underdeveloped distal end of the large caecum. It has propensity for inflammation, which results in the clinical syndrome known as acute appendicitis.[1] The classical features of acute appendicitis begin with central colicky abdominal pain due to midgut visceral discomfort, which is frequently first noticed in the periumbilical region, is associated with anorexia, nausea and usually one or more episodes of vomiting which follow the onset of pain. As the parietal peritoneum becomes affected, the pain becomes more constant and shifts to the right iliac fossa. The diagnosis rests more on thorough clinical examination of the abdomen.

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The cardinal features are those of an unwell patient with low-grade pyrexia, localized abdominal tenderness, muscle guarding and rebound tenderness.[1] The treatment for acute appendicitis has traditionally been open appendicectomy. It was first described in 1894, and has been the standard of treatment for past 100 years due to its efficacy and safety.[2] The first laparoscopic appendicectomy was done much before the laparoscopic cholecystectomy in 1982 by Kurt Semm. It has gradually gained acceptance. Initially it was performed for interval appendicectomies, but later it was considered even for acute appendicitis.[3] Other minimally invasive approaches to appendectomy have been reported, including transvaginal and single-incision laparoscopic surgery (SILS); however, these have not as yet been widely adopted.[4,5] However, there remains a controversy regarding the most appropriate method for appendicectomy. There have been many studies which concluded that laparoscopic appendicectomy is better as compared to open appendicectomy in patients of acute appendicitis, in terms of faster recovery, improved wound healing and earlier return to normal activity,

while other studies found no such benefits or even favored conventional open appendicectomy.[6-8]

## MATERIALS AND METHODS

**Place of study:**

The study was conducted in the department of general surgery Indira Gandhi Medical College Shimla on the patients presenting with the diagnosis of acute appendicitis.

**Inclusion criteria:**

- All cases with diagnosis of Acute appendicitis
- Gender: both male and female.
- Age: all age groups

**Exclusion Criteria:**

- Generalized peritonitis.
- Pregnancy.
- Uncorrected coagulopathy.
- Severe cardiac or pulmonary disease.

**Study Design:**

**Observational descriptive study.**

Total 70 patients were included in the study. 35 patients underwent laparoscopic appendicectomy and 35 patients underwent open appendicectomy.

The patients were assessed preoperatively with clinical history, general physical examination, per abdomen examination, laboratory investigations and ultrasound abdomen. The selected patients were counseled about the procedure and written informed consent was taken regarding participation in the study as well as for the surgical procedure.

In open appendicectomy, spinal anaesthesia technique was used. In laparoscopic appendicectomy, standard general anaesthesia technique of balanced anaesthesia followed in our set up was used.

In open appendicectomy the classical grid-iron incision over the McBurney's point was made. The appendix was found by tracing the teania coli along the caecum to their junction. After the delivery of the appendix, it was held up by a Babcock's or Lane's forceps. The mesoappendix was serially ligated and divided until the base of appendix was reached. The base of appendix was crushed with an artery forecep. The appendix was then ligated at the proximal edge of the crushed portion with 2-0 absorbable suture. The appendix was divided close to the artery forecep and removed. The wound was closed primarily.

In laparoscopic appendicectomy pneumoperitoneum was created using the Veress needle or open Hasson technique, a 10 mm port and endoscope was placed and the diagnosis was confirmed. The second 10 or 12 mm port was placed in the suprapubic area. The third 5mm port was placed in the left iliac fossa lateral to the inferior epigastric vessel. Alternatively, a 10 mm port was placed in the right hypochondrium and a 5 mm port in the left iliac fossa. Once the cecum was identified, the base of the appendix was sought by determining the site of the confluence of the tenia. With elevation of the appendix, the mesoappendix was identified. The mesoappendix was occluded with a bipolar diathermy or liga-clip around the appendicular artery and was divided. The base of the appendix was secured with one or two endoloops constructed with a Roeder knot on a number 1 catgut thread and was divided with bipolar diathermy or harmonic scalpel. The appendix was removed either through the umbilical port or through the second 10 mm port.

**The following parameters were compared between the two groups:-**

1. Operative time.
2. Blood loss.
3. Intra-operative complications e.g. bleeding, vascular injury, visceral injury, bowel injury etc.
4. Analgesic requirement for first 48 hours.
5. Ambulation started (hours after surgery).
6. Bowel sounds recovered (hours after surgery).
7. Clear liquids started (hours after surgery).
8. Regular diet started (hours after surgery).
9. Discharge from the hospital (post op day).
10. Post-operative complications like wound complications e.g. surgical site infection, intra-abdominal abscess formation, post-operative ileus, adhesive intestinal obstruction etc.
11. Return to activity (usual domestic activity).
12. Cosmetic benefit (wound size and external appearance).

**Statistical Analysis:**

The collected data was compiled, tabulated and entered in MS-Excel and statistical analyses were performed using Epi Info version 7. Data were presented as frequency, percentages and mean±SD wherever applicable. For normally distributed data, student t-test was used to compare mean between 2 groups. Chi square test with or without Yates correction was used to compare descriptive variables. P value less than 0.05 was considered significant.

## RESULTS

A total of 70 patients underwent surgery in the study period. 35 patients (50%) had laparoscopic appendicectomy (LA) and 35 patients (50%) had open appendicectomy (OA). Age was ranging from 5 years to 57 years. Out of 70 patients included in the study most of the patients (78.57%) were between 11-40 years of age. The mean age of patients in this study was 28.37±12.13 years in the laparoscopic group and 23.14±12.69 years in the open group. Both the groups were comparable in terms of age distribution (P=0.0825). In the LA group 20 (57.14%) patients were male and 15 (42.86%) patients were female whereas in OA group 19 (54.29%) patients were male and 16 (45.71%)

patients were female. Both the groups were comparable in terms of gender distribution (P=0.809). The mean duration of surgery was less in the laparoscopic group as compared to the open group, however the difference was not statistically significant (P=0.1088). The patients in the laparoscopic group experienced less post-operative pain as compared to the patients in the open group. The mean VAS score in the post-operative period in first 48 hours in the laparoscopic group was 3.36 ±1.37 and in the open group was 5.13±1.29. The difference was statistically significant (P<0.001). The patients undergoing open appendicectomy required more doses of analgesics in the post-operative period. The mean doses of analgesic required in the post-operative period in first 48 hours in the laparoscopic group were 3.09±1.15 and in the open group were 5.63±0.65. The difference was statistically significant (P<0.001). The mean time required after surgery to start ambulation in the LA group was 5.89±3.57 hours and in the OA group was 7.20±1.37 hours. Ambulation was started after surgery earlier in the laparoscopic group compared to the open group and the difference was statistically significant (P=0.0459). The mean time required after surgery for the bowel sounds to appear in the LA group was 12.06±6.97 hours and in the OA group was 15.09±7.02 hours. Both the groups were similar in terms of time required after surgery for the bowel sounds to appear (P=0.0745). The mean time required after surgery to allow clear liquids orally in the LA group was 13.26±6.60 hours and in the OA group was 16.17±7.83 hours. Both the groups were similar in terms of time required after surgery to allow clear liquids orally (P=0.0968). The mean time required after surgery to start regular diet in the LA group was 30±12.93 hours and in the OA group was 33.09±13.76 hours. Both the groups were similar in terms of time required to allow regular diet after surgery (P=0.337). Among 70 patients included in the study 3 (8.57%) patients in the open group and 1 (2.86%) patient in the laparoscopic group developed surgical site infection. Incidence of surgical site infection was less in the LA group as compared to the OA group, however the difference was not statistically significant (P=0.364). Vascular injury occurred in 1(2.86%) patient of laparoscopic group during insertion of trocar. None of the patients in the open group developed any vascular injury. Incidence of vascular injury was less in the LA group as compared to the OA group, however the difference was not statistically significant (P=0.500). 1(2.86%) patients in the open group developed incisional hernia at the site of the surgical scar. None of the patients in the laparoscopic group developed incisional hernia. Incidence of incisional hernia was less in the LA group as compared to the OA group, however the difference was not statistically significant (P=0.500). 1(2.86%) patients in the open group developed adhesive intestinal obstruction, none of the patients in the laparoscopic group developed intestinal obstruction. Incidence of intestinal obstruction was less in the LA group as compared to the OA group, however the difference was not statistically significant (P=0.500). Mean duration of hospital stay in the laparoscopic group was 1.86±1.38 days and in the open group was 3.2±1.80 days. The hospital stay was significantly less in the LA group as compared to the OA group (P<0.001). Mean time taken after surgery to return to normal activity in the laparoscopic group was 3.8±1.83 days and in open group was 5.46±1.92 days. The time taken after surgery to return to normal activity was significantly less in the LA group as compared to the OA group (P<0.001). The mean scar size in the laparoscopic group was 3.89±3.64 cm and in the open group was 7.4 ±1.28 cm. The difference was statistically significant (P<0.001). The scar in the LA group was cosmetically better as compared to the OA group.

## DISCUSSION

The age distribution in the present study was evenly distributed in LA and OA group. Similar results were obtained in the studies done by Gundavda M et al, Ignacio R et al, Biondi A et al, Jain VK et al and Mehta T et al.[9-13] Both the groups were comparable in terms of gender distribution. Similar results were seen in the studies by Strzalka M et al, Gundavda M et al and Kazemier G et al.[3,9,14]

Both the groups were comparable in terms of the duration of surgery. Similar results were seen in the studies done by Islam S et al.[15] 3 of the cases were converted from laparoscopic to open appendicectomy. The conversion rate was 8.57%. In the studies done by Pier A et al,[16] and Islam S et al,[15] the conversion rates were 2% and 3.4 % however in the study done by Richards W et al17 conversion rate was 11 %.

In the present study the patients in the LA group perceived significantly less pain in the post-operative period as compared to the OA group. Similar results were obtained in the study done by Gundavda M et al and Mehta T et al.[9,13] The patients in the LA group required significantly less analgesic as compared to the patients in the OA group. Similar results were obtained in the studies done by Gundavda M et al and Sinha RN.[9,18]

Both the groups were comparable in terms of the time required for the bowel sounds to appear. However in the studies done by Gundavda M et al and Sinha RN time required for the bowel sounds to appear was significantly less in the LA group as compared to the LA group.[9,18] Both the groups were comparable in terms of the time required to allow clear liquids orally. Similar results were seen in the study done by Kazemier G et. Both the groups were similar in terms of the time required to start regular

diet. Similar result was shown in the study done by Kazemier G et al.[14]

Surgical site infection was less in LA as compared to OA group however the difference was not statistically significant. In the studies done by Gundavda M et al,[9] Biondi A et al,[11] Jain VK et al and Mehta T et al surgical site infection was significantly less in patients of LA group as compared to the patients of OA group.[12,13] 1(2.86%) patient in the LA group developed vascular injury during placement of the trocar. The procedure was immediately converted to open midline laparotomy and CTVS team was called. Iatrogenic injury in the right common iliac artery was repaired with prolene 5-0 sutures and haemostasis was ensured and then the appendicectomy was completed. No patient in the OA group developed vascular injury. The difference was not statistically significant (P=0.500). 1 patient (2.86%) in the OA group developed incisional hernia at the site of surgical scar. The patient was readmitted and mesh hernioplasty was done. No patient in the LA group developed incisional hernia. The difference was not statistically significant (P=0.500). 1 patient (2.86%) in the OA group developed adhesive intestinal obstruction. No patient in the LA group developed intestinal obstruction. The difference was not statistically significant (P Value=0.500). Adhesion formation is now one of the common complications following intra-abdominal operation. A study has shown that rate of adhesion is about 80% in OA compared to 10% in LA three months after the surgery.[19]

The patients in the laparoscopic group had significantly lesser duration of stay than the open group mainly due to relatively lesser post operative pain. Similar results were obtained in the studies done by Gundavda M et al, Biondi A et al, Jain VK et al, Mehta T et al and Sinha R et al.[9,11-13,20] The patients in the open group took significantly longer time to return to normal activity due to relatively more post-operative pain. Similar results were obtained in the studies done by Gundavda M et al, Biondi A et al, Jain VK et al and Mehta T et al.[9,12,13] The scar in LA group was significantly better cosmetically as compared to OA group. Similar results were seen in the studies done by Gundavda M et al and Sinha RN.[9,18]

## CONCLUSION

Appendicectomy for acute appendicitis is the most common emergency surgery performed worldwide. Majority of the appendicectomies are still being performed by conventional open technique. Laparoscopic appendicectomy is now being performed increasingly and is better as compared to the open technique in all aspects. Present study clearly proves that laparoscopic appendicectomy is better as compared to open appendicectomy in terms of post-operative pain, analgesic requirement, time to start ambulation, hospital stay, time to return to normal activity and cosmetic outcome. Laparoscopic appendicectomy was comparable to open appendicectomy in terms of operative time, time for the bowel sounds to recover, time to start liquids and regular diet, wound infection and other complications in the present study. Laparoscopic appendicectomy may become the gold standard of care for acute appendicitis.

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