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Original Research Paper

General Surgery

A COMPARATIVE STUDY OF LAPAROSCOPIC VERSUS OPEN APPENDECTOMY

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ABSTRACT **Background-** Appendectomy is accountable for one of the commonest surgical emergencies intervened with options of open appendectomy and laparoscopic approach. Hence we aimed to compare laparoscopic approach and the conventional technique in the treatment of acute appendicitis. **Methods-** This was a prospective study in 60 patients of acute appendicitis who were divided equally into two groups, 30 in open appendectomy and 30 in the laparoscopic approach. Preoperative, intraoperative and postoperative parameters were compared and analyzed between two groups. **Results-** In this study, laparoscopic appendectomy was associated with a longer operating time (70 minutes' vs 38.5 minutes). Laparoscopic appendectomy had less pain (Mean pain score were 2.53 on POD 1, 0.96 on POD 2, 0.3 on POD 3) and lesser number of doses of mean analgesic (2.96 on POD 1, 0.8 on POD 2 and 0.2 on POD 3). Laparoscopic appendectomy resumed normal activity earlier (mean of 1.3 vs 2.23 days) (P-value =0.0001) Also, they returned to work earlier (mean of 9.16 vs 15.03 days) (P-value =0.0001). Wound infection was post operative complication noted with grade I infection in 2 cases of laparoscopic appendectomy and 4 cases of grade I infection and 2 cases of grade II infection in open appendectomy **Conclusion-** The laparoscopic intervention can be safe alternate procedure in appendectomy for acute appendicitis (decreased need for postoperative analgesia, earlier return to work, earlier return to normal activity and lower rate of wound infection)

KEYWORDS : Appendicitis, Appendectomy, Laparoscopy, open appendectomy

INTRODUCTION

Acute abdomen stands amongst one of the commonest surgical emergencies. Appendicitis is the inflammation of the vermiform appendix.(1) On an average, 7–10 % of the population experiences episodes of acute appendicitis with peak in the second and third decades of life.(2) Males have sex predilection to develop acute appendicitis than females, with a lifetime incidence of 8.6% and 6.7% for men, and women, respectively.(3) Within 24 hours of onset, it typically presents acutely, however, it can also present as a more chronic condition.(1) The surgical treatment of choice of appendicitis is removal of the inflamed appendix either by using conventional open appendectomy as explained by McBurney or by laparoscopic appendectomy as explained by Semm.(4)

Open appendectomy has been the gold standard for acute appendicitis for about a century, but the precedence and efficiency of laparoscopic intervention is the subject of global disparity.(5) The actuality of minimal surgical trauma, ensuing in remarkably smaller hospital stay, brisk rebound to daily activities, reduced wound related complications and less postoperative pain has made laparoscopic surgery for acute appendicitis more advisable.(6) Nonetheless, the extravagant treatment cost and longer duration of the operation makes laparoscopic surgery slackening.(7) Many retrospective studies and several randomized trials have compared laparoscopic approach with open appendectomy. They have appraised results at variance. Few of them have resulted in better clinical outcomes favouring laparoscopic approach while other have shown marginal or no clinical benefits with higher economical burden.(7-9) Considering the former data, we designed the present study to resolute any possible benefits of the laparoscopic approach. Hence we focused to better understand if laparoscopic appendectomy fares against conventional appendectomy in the treatment of appendicitis.

Methods

This was a prospective study conducted in 60 patients of acute appendicitis who were admitted in Department of surgery, tertiary care teaching institute after obtaining approval of institutional ethics committee and written consent. Total duration of study was from January 2021 to August 2023. Patients satisfying the following inclusion and exclusion criteria and willing to participate in this study were enrolled in the study. The patients were divided into two groups: open appendectomy (30) group and laparoscopic appendectomy (30) group.

Inclusion Criteria

All patients of acute appendicitis admitted in surgery ward were included

Exclusion Criteria

Patients of appendicular mass, appendicular abscess, appendicular perforation, severe medical disease (hemodynamic instability, chronic medical or psychiatric illness, cirrhosis, coagulation disorders) requiring intensive care and pregnant females were excluded

The collected clinical data comprised operation time, intraoperative findings, amount of analgesics, time to rebound daily activities and postoperative complications. The diagnosis was made clinically with history (right iliac fossa or periumbilical pain, nausea/vomiting), physical examination (tenderness or guarding in right iliac fossa). In patients where a clinical diagnosis could not be established, imaging studies such as abdominal ultrasound or computed tomography were performed. All patients undergoing laparoscopic procedure were operated under general anaesthesia and those undergoing open surgery under general/ spinal anesthesia. A single dose of antibiotic was administered as prophylaxis at the time of induction of anesthesia. A note was made using the visual analogue scale (VAS) of severity of pain. Data was entered and analyzed in Microsoft Excel. Relevant statistical analysis was done using SPSS v.16

OBSERVATIONS AND RESULTS

Table 1. Baseline Characteristics (n= 60)

Parameter	Open appendectomy	Laparoscopic appendectomy
Gender		
Male	18	11

Female	12	19
Mean Age	28.62+ 9.7 years	25.62+ 8.2 years

In our study, males were in more number than females in open but females were predominant in laparoscopic interventions. Mean age found was 28.62+ 9.7 years in open appendectomy and 25.62+ 8.2 years in laparoscopic approach of appendectomy(Table 1)

Table 2. Comparison Of Pain On Post Operative Days (n= 60)

Pain in post operative day 1							
Approach	N	Mean	SD	Mini-mum	Maxi-mum	Unpaired t test	P-value
LAP	30	2.53	0.77	1.0	4.0	5.64	0.0001
Open	30	4	1.20	2.00	6.00	Difference is significant	
Pain in post operative day 2							
LAP	30	0.96	0.61	0.00	2.00	3.62	0.0001
Open	30	1.56	0.67	1.00	3.00	Difference is significant	
Pain in post operative day 3							
LAP	30	0.3	0.46	0.00	1.00	1.71	0.090
Open	30	0.53	0.57	0.00	2.00	Difference is not significant	

SD= Standard deviation, LAP= Laparoscopic approach

In our study, on postoperative day (POD) 1 and 2, the patients who underwent laparoscopic appendectomy had less pain as compared to those undergoing open appendectomy. Mean pain score values in the laparoscopic and open groups were 2.53 versus 4.0 respectively on POD 1 and 0.96 vs 1.56 respectively on POD 2, which was statistically significant.(All P-values =0.0001) On POD 3, patients undergoing laparoscopic appendectomy had a mean pain score of 0.3 as against a mean score of 0.53 in the open group. However, this was not statistically significant.(P-value = 0.09)(Table 2)

Table 3. Comparison Of Requirement Analgesic On Post Operative Days (n= 60)

Analgesic in post operative day 1							
Approach	N	Mean	SD	Mini-mum	Maxi-mum	Unpaired t test	P value
LAP	30	2.96	0.66	1.00	3.00	4.93	0.0001
Open	30	1.86	0.68	2.00	4.00	Difference is significant	
Analgesic in post operative day 2							
LAP	30	0.80	0.55	0.00	2.00	5.34	0.0001
Open	30	1.70	0.74	1.00	3.00	Difference is significant	
Analgesic in post operative day 3							
LAP	30	0.20	0.40	0.00	1.00	4.42	0.0001
Open	30	0.73	0.52	0.00	2.00	Difference is significant	

SD= Standard deviation, LAP= Laparoscopic approach

In our study, patients who underwent laparoscopic appendectomy required significantly lesser number of doses of analgesic as compared to those undergoing open appendectomy. The mean required dosages for the 2 groups in the laparoscopic and open groups were 2.96 versus 1.86 respectively on POD 1 and 0.8 vs 1.7 respectively on POD 2. Similarly, on POD 3, mean analgesic requirement was 0.2 vs 0.73 in laparoscopic and open method respectively. For all 3 PODs, difference was statistically significant.(All P-values =0.0001)(Table 3)

Table 4. Comparison Of Resumption To Normal Activity And Work On Post Operative Days (n= 60)

Resumption of normal activities							
Approach	N	Mean	SD	Mini-mum	Maxi-mum	Unpaired t test	P value
LAP	30	1.30	0.46	1.00	2.00	7.49	0.0001
Open	30	2.23	0.50	2.00	3.00	Difference is significant	
Resumption to work							
LAP	30	9.16	1.89	7.00	15.00	11.56	0.0001
Open	30	15.03	2.04	12.00	20.00	Difference is significant	

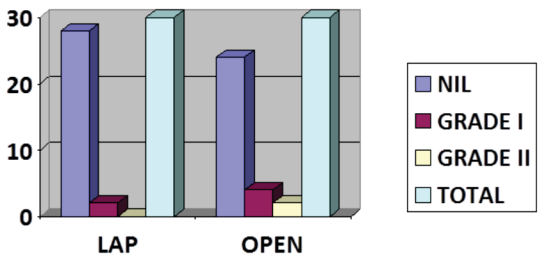
SD= Standard deviation, LAP= Laparoscopic approach

In our study, the patients who had undergone laparoscopic appendectomy resumed normal activity earlier with mean of 1.3 days as compared to 2.23 days in patients who had undergone open appendectomy and difference between the two was statistically significant (P-value =0.0001) Also, the patients who had undergone laparoscopic appendectomy returned to work earlier with mean of 9.16 days as compared to 15.03 days in patients who had undergone open appendectomy and difference between two was statistically significant (P-value =0.0001).(Table 4)

Table 5. Comparison Of Duration Of Surgery (n= 60)

Duration	N	Mean	SD	Mini-mum	Maxi-mum	Unpaired t test	P-level
LAP	30	70.5	10.7	500.00	90.00	9.63	0.0001
Open	30	48	7.02	35.00	60.00	Difference is significant	

In our study, mean operating time in patients undergoing laparoscopic appendectomy was 70.5 minutes as compared to 48 minutes in patients who underwent open appendectomy.(Table 5)



SD= Standard deviation, LAP= Laparoscopic approach
Figure 1. Grades Of Wound Infection (n=60)

In our study, wound infection in both groups was compared. There was grade I infection in 2 cases of laparoscopic appendectomy. Whereas 4 cases of grade I infection and 2 cases of grade II infection were noticed in open appendectomy.(Figure 1)

DISCUSSION

Appendicitis can be included in one of the commonest causes of acute abdomen and should be suspected in patients presenting with acute abdominal pain localised to right iliac fossa. Laparoscopic approach can be considered as a major surgical advance which has privileged surgeon to stretch into superspeciality era.(1) Several studies have shown that laparoscopic appendectomy is safe and results in a faster return to normal activities with fewer wound complications. These findings have been challenged by other authors who observed no significant difference in the outcome between the two procedures, and moreover noted higher costs with laparoscopic appendectomy.(8-11)

The principal finding of the present study suggested that mean operating time in patients undergoing laparoscopic appendectomy was 70.5 minutes as compared to 48 minutes in patients who underwent open appendectomy. Long operative time is a primary concern influencing the widespread use of Laparoscopic appendectomy. Biondi et al., also found similar

data with the mean±standard deviation operative time of 54.9±14.7 min for the laparoscopy group which was longer than the mean operative time of 31.36±11.43 min for open appendectomy, which was statistically significant (P value<0.0001).(5) Generally, scarcity of experienced surgeons in the laparoscopic approach may add up to a longer intra operative time.(6) By contrast, in the present study surgeons performing the procedures were highly experienced in laparoscopic procedures. So, in our series the longer operation time in laparoscopic appendectomy can be due to additional steps like setup of instruments, insufflation, making ports under vision and a phase of diagnostic laparoscopy. Fatma et al., also found laparoscopic appendectomy with mean of 48±19 mins of surgery duration and open appendectomy with mean of 46±15mins (P value=0.748).(14) Wei et al., appraised shorter time for open appendectomy with mean time of 28.7±16.3 mins than for the laparoscopic patients with mean time of 30±15.2 mins.(9) Pradhan et al., demonstrated mean operative time of surgery to be 37.9 ± 9.8 minutes in open surgery and in laparoscopy, mean operative time of surgery was 42.8 ± 10.8 minutes with P value of 0.86.(10)

In present study, the patients who had undergone laparoscopic appendectomy resumed normal activity earlier with mean of 1.3 days as compared to 2.23 days in patients (P-value =0.0001) and returned to work earlier with mean of 9.16 days as compared to 15.03 days in patients who had undergone open appendectomy (P-value =0.0001). Patients who recover quickly in the postoperative period are usually discharged from the hospital and return to work earlier. Regarding postoperative recovery and hospital stay, many researchers found that an early return to daily activity and work is an obvious advantage of laparoscopic appendectomy. During the laparoscopic approach, trocar incisions cause minimal trauma to the abdominal wall and are less painful in the postoperative period.(16) Islam et al., found that the mean time taken for returning to normal activity was significantly lower in the laparoscopic group (7.68 days) compared with the conventional group (16.78 days).(17) Wei et al., also was in consensus with our study data as they found that cases who underwent open method (13.7 days) took longer time to return to normal work than laparoscopic approach (9.1 days). (9)

In present study, wound infection was grade I infection in 2 cases of laparoscopic appendectomy while 4 cases of grade I infection and 2 cases of grade II infection were noticed in open appendectomy. Biondi et al., appraised complication rates as 24.5 % and 6.7 % for open and laparoscopic appendectomy respectively, with a rate of wound infection and dehiscence significantly higher in the open group (p value <0.001). Usually, wound infection is very ubiquitous in complicated appendicitis and can have a strong consequence for convalescence time and quality of life of patients.(5) In our study, the lower rate of wound infection in laparoscopic group can be a resultant of placement of the detached appendix into an endobag before its removal from the abdominal cavity, reducing contact with the fascial surfaces and minimizing contamination. Several hypotheses have been suggested to find possible explanations: mechanical spread of bacteria in the peritoneal cavity promoted by carbon dioxide insufflation, especially in case of ruptured appendix, the meticulous irrigation instead of simple suctioning of the infected area in severe peritonitis, that leads to contamination of the entire abdominal cavity, which is difficult to aspirate latter.(4,6) Other observed postoperative complications can be vomiting, paralytic ileus and haemoperitoneum, enterocutaneous fistula surgical site infection or stump appendix.(2)

In present study, POD 1 and 2, the patients who underwent laparoscopic appendectomy had less pain with mean pain score values in the laparoscopic and open groups as 2.53 versus 4.0 respectively on POD 1 and 0.96 vs 1.56 respectively on POD 2 (All P-values =0.0001) On POD 3, patients undergoing laparoscopic appendectomy had a mean pain score of 0.3 as against a mean score of 0.53 in the open group. (P-value = 0.09) The mean required dosages of analgesic for the 2 groups in the laparoscopic and open groups were 2.96 versus 1.86 respectively on POD 1 and 0.8 vs 1.7 respectively on POD 2. Similarly, on POD 3, mean analgesic requirement was 0.2 vs 0,73 in laparoscopic and open method respectively. (All P-values =0.0001) This may be due to the smaller incisions and less tissue trauma associated with laparoscopy. Patients who undergo laparoscopy also require less pain medication postoperatively. Islam et al., evaluated that laparoscopy was associated with significantly less postoperative pain with the mean post-operative pain score at 12 hrs, POD 1, and POD 2 being 4, 3.3, and 2.04 in laparoscopy compared to 7.1, 6.32 and 5.7 in open appendectomy.(17) Biondi et al., explained that, to prevent that the perception of pain by the patient's enthusiasm for a novel technique, they used only the number of analgesics doses (oral and parenteral) required by individual patient to compare the 2 groups. They determined that parenteral and oral analgesic requirements were less in the laparoscopic group [parenteral 1 (mean); oral 1.86 (mean)] than in the open group [parenteral 1.5 (mean); oral 2 (mean)] (P<0.001).(5) Shaikh et al., also appraised that significantly less use of analgesic in laparoscopic group (2.24 days) than in the open (7.25 days) was required.(18) Geeta et al., also reported to have lower duration of analgesic use in the laparoscopic group (3.31days) than in the open group (7.05 days).(19)

In present study, males were dominant in open but females were predominant in laparoscopic interventions. Mean age found was 28.62± 9.7 years in open appendectomy and 25.62± 8.2 years in laparoscopic approach of appendectomy. Basukula et al., and Simoda et al., also found similar mean age, in consensus with our data.(2,20) Similarly, Biondi et al., and Basukula et al., also supported us with male sex predilection.(5,2) Islam et al., also had similar finding with 56% males in conventional method and 58% females in laparoscopic method.(17) Biondi et al., found the mean age of 29.66 years in open method and in laproscopy the mean age was 27.75 years.(5)

CONCLUSION

From this study, it can be concluded that laparoscopic approach offers advantages in terms of lesser postoperative pain and analgesic requirements as well as a significantly early return to work. The incidence of chronic debilitating pain is also significantly lower than with appendectomy. Laparoscopic appendectomy is equally safe, and can provide less postoperative morbidity in experienced hands, as open appendectomy. With better training in minimal access surgery now available, the time has arrived for it to take its place in the surgeon's repertoire. We recommend, large scale research with big patient population to validate our findings. However, surgical expertise integrated by early management will greatly ameliorate survival in uncomplicated appendicitis.

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