

A Comparative Clinical Study of Therapeutic Effects and Safety of Laparoscopic and Conventional "Open" Appendectomy

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ABSTRACT

BACKGROUND

Acute appendicitis is a common disease seen by practicing surgeons in India. The prevalence in India is between 7.4 to 9.2%. Appendectomy is a very common surgical procedure performed in hospitals. It affects all age groups. Open appendectomy (OA) is being replaced by laparoscopic appendectomy (LA) nowadays in India. However, there are few controversies in the literature regarding the most appropriate method of removing the inflamed appendix.

METHODS

68 Patients admitted in the Department of General Surgery with Acute Appendicitis were randomly allotted to Open Appendectomy group (OA group- 34) and Laparoscopic Appendectomy group (LA group- 34). All patients were investigated with fixed surgical profile including, hematological, respiratory, cardiovascular and kidney function tests. A random number obtained from online random.org was used to allot the patients to either of the groups of LA and OA. All the surgeries were performed by the same surgeon and anaesthetist team. All patients had a BMI less than 25 Kg/m² to 35 Kg/m².

RESULTS

Out of 68 patients, 45 (66.17%) were males and 23 (33.82%) females with a male to female ratio of 1.95:1. The mean age was 24.15 ± 2.55 years. In group LA there were 21 (61.76%) males and 13/34 (38.23%) were females with a male to female ratio of 1.61:1. In group OA there were 23/34 (67.64%) males and 11/34 (32.35%) females with a male to female ratio of 2.09:1. The mean basal metabolic rate in group LA was 31.50 Kg/m² and in group OA was 31.70 Kg/m². It was observed from this study that the parameters of operative and post-operative recovery period in terms of operation time, mean hospital stay, mean resumption of time of normal activities, mean resumption of time of normal diet and VAS score for postoperative pain were statistically significant (p taken as significant at <0.05).

CONCLUSIONS

Operating time, postoperative length of hospital stay, resumption time of normal activities and diet, and postoperative pain (assessed by visual analogue scale (VAS) graded from 0 to 10, with 0 being no pain and 10 being the most intense pain) were favourable with laparoscopic surgery than with open appendectomy. Complications such as postoperative ileus, intraoperative bleeding (>500 mL), urinary tract infection (UTI) and intra-abdominal abscess (IAA) formation following LA vs. OA techniques were not significant except wound infection which was significantly low with LA group.

KEYWORDS

Acute Appendicitis, Laparoscopy, Open Abdominal Surgery, Complications and Hospital Stay

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BACKGROUND

The first successful appendectomy was described by McBurney in 1894.¹ The OA remained the gold standard for nearly a century. The lifetime risk of developing appendicitis is between 7 and 9% with evidence of increasing incidence in India.² Semm a Gynaecologist³ first described the laparoscopic Appendectomy in 1983.⁴ After withstanding the initial resistance for its acceptance LA now has become the choice of Appendectomy in India.⁵ LA gained the popularity over OA because of its advantages like decreased postoperative pain, more rapid return to daily activities, and improved cosmetic results. However, the literature has shown the association of laparoscopy with specific adverse events such as increased intra-abdominal abscess and hospital costs.⁶ Diagnosis is based on history, clinical examination and laboratory tests, although 30–45% of patients exhibit atypical signs and symptoms on presentation. Where the diagnosis remains ambiguous, ultrasound and CT scans are the most widely used imaging modalities.⁷ In prospective non-randomized trial 500 appendectomies, it was observed that 362 children underwent open procedure and 138 underwent Laparoscopic appendectomy (LA) and there was no mortality in either group. Major complications were 3% in open group, but no major complications were seen in the laparoscopic group. Minor complications were 20% in open and 13% in LA.⁸ Similarly Sweeney et al, predicted and proved that LA causes less postoperative pain than its conventional counterpart.⁹ The present study was aimed to compare both laparoscopic and mini-incision appendectomies in terms of operation duration, postoperative complications, length of hospital stay, cost analyses, and cosmetic results.

We wanted to compare the therapeutic effects and safety of laparoscopic and conventional "open" appendectomy by means of a Hospital based clinical study.

METHODS

The present study was conducted in a tertiary teaching General Hospital in Telangana. 68 Patients admitted in the department of General surgery with Acute Appendicitis were randomly allotted to Open Appendectomy group (OA group- 34) and Laparoscopic Appendectomy group (LA group- 34). An ethical committee clearance certificate was obtained before commencement of the study. An ethical committee cleared consent form was used for this study.

Inclusion Criteria

1. Patients of both genders aged between 15 and 50 years were included.
2. Patients with symptoms and signs of Acute Appendicitis were included.

Exclusion Criteria

1. Patients aged below 16 and above 60 years were excluded.
2. Patients with Co-morbidities like diabetes, Hypertension, history of smoking, previous laparoscopic or abdominal surgeries were excluded.
3. Patients with Appendicular abscess, chronic Appendicitis, perforation, peritonitis and paralytic ileus were excluded.

All the patients were investigated with fixed surgical profile to include, haematological, Respiratory, cardiovascular and kidney function tests. A random number obtained from online random.org was used to allot the patients to either of the groups of LA and OA. All the surgeries were performed by the same surgeon and anaesthetist team. The following criteria were observed:

1. All of the patients had a BMI less than 25 Kg/m² to 35 Kg/m².
2. Surgical Technique for LA: General anaesthesia was used in LA group. For the laparoscopic approach, the Hasson technique was used and a 10 mm 30° angled scope was used through the 10 mm umbilical trocar and additional two trocars (10 mm and 5 mm) are placed in the lower abdomen. Mesoappendix was divided by using Ligasure device and the appendix stump was clipped by Hem-o-lok polymer ligation clips. The specimen was removed through the 10 mm suprapubic trocar in a specimen bag. The trocars were removed under direct vision and all trocar sites are closed using 3-0 absorbable monofilament sutures.
3. Surgical Technique for OA: Regional anaesthesia or General anaesthesia was used in this group. A 1.5 to 2 cm oblique incision from Mc Burney's point was used for laparotomy instead of classical Mc Burney incision. Mesoappendix and appendix stump were ligated by 2/0 silk sutures. The stump was routinely inverted with purse string sutures.

The peritoneum was closed by using 3/0 vicryl sutures and the fascia was closed by using non-absorbable monofilament sutures. The incision was closed by using 4/0 absorbable monofilament suture. The data of the patients collected was clinical diagnosis of acute appendicitis including demographic data (age, gender and diet), preoperative laboratory and radiologic findings, operation type, operation duration, and postoperative course (complications, length of hospital stay, cost analyses, and postoperative cosmetic results). Postoperative pain was assessed by visual analogue scale (VAS) graded from 0 to 10, with 0 being no pain and 10 being the most intense pain) was recorded.

RESULTS

68 patients diagnosed with Acute Appendicitis were included in a prospective comparative study in a tertiary teaching Hospital. The study was conducted in the department of General Surgery by a team of doctors belonging to General surgery and Anaesthesiology. The patients were randomly assigned to two groups namely LA group-34 patients and OA group-34 patients. Out of 68 patients there were 45 (66.17%) males and 23 (33.82%) females with a male to female ratio of 1.95:1. The mean age was 24.15 ± 2.55 years. In group LA there were 21 (61.76%) males and 13/34 (38.23%) were females with a male to female ratio of 1.61:1. I group OA there were 23/34 (67.64%) males and 11/34 (32.35%) females with a male to female ratio of 2.09:1. The mean basal metabolic rate in group LA was 31.50 Kg/m² and in group OA was 31.70 Kg/m² (Table 1).

Observation	Male- 45	Female- 23	M:F Ratio
Age			
15 to 25 Yrs.- 28 (41.17%)	18 (40.00%)	10 (43.47%)	1.80:1
26 to 35 yrs.- 22 (32.35%)	16 (35.55%)	06 (26.08%)	2.66:1
36 to 45 yrs.- 10 (14.70%)	06 (13.33%)	04 (17.39%)	1.50:1
46 to 50 Yrs.- 08 (11.76%)	05 (11.11%)	03 (13.04%)	1.66:1
Mean BMI	31.62	31.42	-
Diet			
Non- Vegetarian	26 (57.77%)	15 (65.21%)	1.73:1
Vegetarian	19 (42.22%)	08 (34.78%)	2.37:1

Table 1. Demographic Data of the Subjects (n-64)

In this study laparoscopic Appendicectomy (LA) operation time was ranging from 41.35 minutes to 65.48 minutes with a mean time of 51.46 minutes (12.35 min longer than open Appendicectomy (OA) (95% CI: 8.79 to 17.52, p <0.001). The mean operating time of OA being 39.11 minutes (Table 2). In this study the Hospital stay in patients undergoing laparoscopic Appendicectomy was ranging from 1.45 days to 2.60 days with a mean hospital stay of 2.02 days which was 0.74 days shorter than Open Appendicectomy (95% CI: -0.83 to -0.33, p < 0.001), (Table 2). In OA the patients Hospital stay was ranging from 2.19 to 3.34 days with a mean hospital stay of 2.76 days (Table 2). The time taken to resume normal activity in patients undergone LA was ranging from 8.32 to 11.46 days with a mean duration of 09.89 days which was 4.15-days less than patients undergone OA surgery, (95% CI: -5.95 to -3.10, p <0.001). In OA the patients the duration taken to return to normal activity was ranging from 12.47 to 15.61 days with a mean duration of 14.04 days (Table 2). The time taken to resumption of normal diet in patients undergone LA was ranging from 11.74 to 13.95 days with a mean duration of 12.84 days which was 0.84 days less than patients undergone OA surgery (95% CI: -0.44 to -0.25, p <0.001). In OA the patients the duration taken to return to normal diet was ranging from 12.58 to 14.79 days with a mean duration of 13.68 days (Table 2). It was observed from this study that the parameters of operative and post-operative recovery period in terms of operation time, Mean Hospital

stay, Mean Resumption of time of normal activities, Mean Resumption of time of normal diet and VAS score for Postoperative Pain were statistically significant (p taken as significant at <0.05), (Table 2).

Among the 34 patients of LA group showed 2/34 (05.88%) patients had wound infection compared with 5/34 (14.70%) patients of OA surgery. The difference was statistically significant (95% CI: 0.33 to 0.58, p <0.001), (Table 3). In this study the incidence of postoperative ileus was 1/34 (02.94%) patients of OA group and 0/34 (0%) of LA group. Although the results showed that LA surgery has resulted in a reduced incidence of postoperative ileus, the difference was not statistically significant (p<0.05), (Table 3). The incidence of intra operative bleeding was 03/34 (08.82%) in LA group and 0/34 (0%) in OA group of patients. But this was not statistically significant (p>0.05), (Table 3). The incidence of postoperative Urinary Tract Infection (UTI) was 1/34 (02.94%) in both the LA and OA groups and was not statistically significant (p>0.05), (Table 3). Intra-abdominal abscess occurred in 2/34 (05.88%) of patients in LA group and no (0%) incidence of Intra-abdominal abscess in OA group. This observation was also not significant statistically (p value >0.05), (Table 3).

Observation	OA Group- 34	LA Group- 34	P Value
Male	23 (67.64%)	21 (61.76%)	0.103
Female	11 (32.35%)	13 (38.23%)	0.965
Mean Operating time	39.11 minutes	51.46 minutes	0.001
Mean Hospital stay	2.76 days	2.02 days	0.001
Mean Resumption of time of normal activities	14.04 days	09.89 days	0.001
Mean Resumption of time of normal diet	13.68 days	12.84 days	0.001
VAS score for Postoperative Pain	1 to 4	2 to 7	0.001

Table 2. Post-Operative Parameters Studied in Subjects of Both Groups (n-68)

Observation	OA Group- 34	LA Group- 34	P Value
Wound infection	05- (14.70%)	02- (05.88%)	0.001
Paralytic ileus	01 (02.94%)	0- (%)	0.067
Intra-operative bleeding	0- (0%)	03- (08.82%)	0.071
Urinary tract infection	01- (2.94%)	01- (02.94%)	0.120
Intra-abdominal Abscess	02- (05.88%)	0 (0%)	0.250

Table 3. Complications Observed in the Study in both Groups (n-64)

In the present study to summarize interesting and statistical significant outcomes were, operating time, postoperative length of hospital stay, resumption time of normal activities and diet, and postoperative pain (assessed by visual analogue scale (VAS) graded from 0 to 10, with 0 being no pain and 10 being the most intense pain) were advantageous with laparoscopic surgery than Open Appendicectomy. The observations of complication such as postoperative ileus, intraoperative bleeding (>500 mL), urinary tract infection (UTI) and intra-abdominal abscess (IAA) formation following LA vs. OA techniques were not significant except wound infection which was significantly low with LA group (Table 3).

DISCUSSION

Acute appendicitis is a very common surgical disease seen in General surgery practice affecting both adult and pediatric population with a worldwide prevalence of 7 to 8%.² In this study 68 patients diagnosed with Acute Appendicitis were included in a prospective comparative study in a tertiary teaching Hospital. The study was conducted in the department of General Surgery by a team of doctors belonging to General surgery and Anaesthesiology. The patients were randomly assigned to two groups namely LA group-34 patients and OA group-34 patients. Out of 68 patients there were 45 (66.17%) males and 23 (33.82%) females with a male to female ratio of 1.95:1. The mean age was 24.15 ± 2.55 years. In group LA there were 21 (61.76%) males and 13/34 (38.23%) were females with a male to female ratio of 1.61:1. In group OA there were 23/34 (%) males and 11/34 (%) females with a male to female ratio of 2.09:1.

The mean basal metabolic rate in group LA was 31.50 Kg/m^2 and in group OA was 31.70 Kg/m^2 (Table 1). In this study laparoscopic Appendectomy (LA) operation time was ranging from 41.35 minutes to 65.48 minutes with a mean time of 51.46 minutes (12.35 min longer than open Appendectomy (OA) (95% CI: 8.79 to 17.52, $p < 0.001$). The mean operating time of OA being 39.11 minutes (Table 2). In this study the Hospital stay in patients undergoing laparoscopic Appendectomy was ranging from 1.45 days to 2.60 days with a mean hospital stay of 2.02 days which was 0.74 days shorter than Open Appendectomy (95% CI: -0.83 to -0.33, $p < 0.001$), (Table 2).

In OA the patients Hospital stay was ranging from 2.19 to 3.34 days with a mean hospital stay of 2.76 days (Table 2). The time taken to resume normal activity in patients undergone LA was ranging from 8.32 to 11.46 days with a mean duration of 09.89 days which was 4.15-days less than patients undergone OA surgery, (95% CI: -5.95 to -3.10, $p < 0.001$). In OA the patients the duration taken to return to normal activity was ranging from 12.47 to 15.61 days with a mean duration of 14.04 days (Table 2). The time taken to resumption of normal diet in patients undergone LA was ranging from 11.74 to 13.95 days with a mean duration of 12.84 days which was 0.84 days less than patients undergone OA surgery (95% CI: -0.44 to -0.25, $p < 0.001$). In OA the patients the duration taken to return to normal diet was ranging from 12.58 to 14.79 days with a mean duration of 13.68 days (Table 2).

It was observed from this study that the parameters of operative and post-operative recovery period in terms of operation time, Mean Hospital stay, Mean Resumption of time of normal activities, Mean Resumption of time of normal diet and VAS score for Postoperative Pain were statistically significant (p taken as significant at < 0.05), (Table 2). Similarly, a study conducted by Rbihat et al¹⁰ showed that the mean time for laparoscopic and OA group was 55 minutes and 22 minutes respectively with the duration of stay was two days in open surgery group whereas the

laparoscopic group was only one day and 8 out of 159 had wound infection in OA group.

The study done by Vellani et al,¹¹ the mean post-operative stay in days was relatively shorter for LA (1.97 ± 2.3) compared to OA (3.1 ± 1.8). The average time for the return of bowel movement was remarkably lesser for LA (10.6 ± 8.2) hours than OA (21 ± 13) hours. A study conducted among 593 patients by Biondi et al¹² showed that the LA was associated with a shorter hospital stay with a less need for analgesia and with a faster return to daily activities. Operative time was significantly shorter in the open group (31.36 ± 11.13 min in OA and 54.9 ± 14.2 in LA). Total number of complications was less in the LA group with a significantly lower incidence of wound infection (1.4% vs. 10.6%). A recent systematic review of meta-analyses of randomized controlled trials comparing laparoscopic versus OA concluded that both procedures are safe and effective for the treatment of acute appendicitis. Even though LA has been claimed to reduce postoperative pain, length of hospitalisation, analgesic doses and surgery associated complication, many surgeons do not advocate this procedure on men because they do not find any superiority of laparoscopy over the open procedure. The risk of wound infection is less in LA compared to the open procedure.¹³

A meta-analysis of randomized controlled trials reported the observations among the 2877 patients included in 28 trials¹⁴ showed overall complication rates were comparable in LA group and OA groups, but wound infections were definitely reduced after laparoscopy. In this study among the 34 patients of LA group showed 2/34 (05.88%) patients had wound infection compared with 5/34 (14.70%) patients of OA surgery. The difference was statistically significant (95% CI: 0.33 to 0.58, $p < 0.001$), (Table 3). In this study the incidence of postoperative ileus was 1/34 (02.94%) patients of OA group and 0/34 (0%) of LA group.

Although the results showed that LA surgery has resulted in a reduced incidence of postoperative ileus, the difference was not statistically significant ($p < 0.05$), (Table 3). The incidence of intra operative bleeding was 03/34 (08.82%) in LA group and 0/34 (0%) in OA group of patients. But this was not statistically significant ($p > 0.05$), (Table 3). The incidence of postoperative Urinary Tract Infection (UTI) was 1/34 (02.94%) in both the LA and OA groups and was not statistically significant ($p > 0.05$), (Table 3).

Intra-abdominal abscess occurred in 2/34 (05.88%) of patients in LA group and no (0%) incidence of Intra-abdominal abscess in OA group. This observation was also not significant statistically (p value > 0.05), (Table 3). LA is equally safe, and can provide less postoperative morbidity in experienced hands, as open appendectomy. Most cases of acute appendicitis can be treated by laparoscopic approach. LA is a useful method for reducing hospital stay & post-op complications, but more operative time is required. We found a considerable preference (during the collection of consent) of patients and a high satisfaction after the surgery in the laparoscopic group. But in developing countries, total hospital costs are still a serious problem.

CONCLUSIONS

Operating time, postoperative length of hospital stay, resumption time of normal activities and diet, and postoperative pain (assessed by visual analogue scale (VAS) graded from 0 to 10, with 0 being no pain and 10 being the most intense pain) were favourable with laparoscopic surgery than with open appendectomy. Complications such as postoperative ileus, intraoperative bleeding (>500 mL), urinary tract infection (UTI) and intra-abdominal abscess (IAA) formation following LA vs. OA techniques were not significant except wound infection which was significantly low with LA group. Mini-incision appendectomy seems to be an alternative for selected patients with lower body mass index and non-complicated appendicitis.

REFERENCES

- [1] McBurney C. The incision made in the abdominal wall in cases of appendicitis, with a description of a new method of operating. *Ann Surg* 1894;20(1):38-43.
- [2] Addiss DG, Shaffer N, Fowler BS, et al. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol* 1990;132(5):910-925.
- [3] Buckius MT, McGrath B, Monk J, et al. Changing epidemiology of acute appendicitis in the United States: study period 1993–2008. *J Surg Res* 2012;175(2):185-190.
- [4] Semm K. Endoscopic appendectomy. *Endoscopy* 1983;15(2):59-64.
- [5] Litynski GS. Kurt Semm and the fight against skepticism: endoscopic hemostasis, laparoscopic appendectomy, and Semm's impact on the "laparoscopic revolution". *JLS* 1998;2(3):309-313.
- [6] McGrath B, Buckius MT, Grim R, et al. Economics of appendicitis: cost trend analysis of laparoscopic versus open appendectomy from 1998 to 2008. *J Surg Res* 2011;171(2):e161-e168.
- [7] Sellars H, Boorman P. Acute appendicitis. *Surgery* 2017;35(8):432-438.
- [8] Paya K, Fakhari M, Rauhofer U, et al. Open versus laparoscopic appendectomy in children: a comparison of complications. *JLS* 2000;4(2):121-124.
- [9] Sweeney KJ, Keane FBV. Moving from open to laparoscopic appendectomy. *BJS* 2003;90(3):257-258.
- [10] Rbihat HS, Mestareehy KM, Al Lababdeh MS, et al. Laparoscopic versus open appendectomy retrospective study. *Int J Adv Med* 2017;4(3):620-622.
- [11] Vellani Y, Bhatti S, Shamsi G, et al. Evaluation of laparoscopic appendectomy vs. open appendectomy: a retrospective study at Aga Khan University Hospital, Karachi, Pakistan. *J Pak Med Assoc* 2009;59(9):605-608.
- [12] Biondi A, Di Stefano C, Ferrara F, et al. Laparoscopic versus open appendectomy: a retrospective cohort study assessing outcomes and cost-effectiveness. *World J Emerg Surg* 2016;11(1):44.
- [13] Li X, Zhang J, Sang L, et al. Laparoscopic versus conventional appendectomy - a meta-analysis of randomized controlled trials. *BMC Gastroenterol* 2010;10:129.
- [14] Keus F, de Jong JAF, Gooszen HG, et al. Laparoscopic versus open cholecystectomy for patients with symptomatic cholelithiasis. *Cochrane Database Syst Rev* 2006;(4):CD006231.