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Laparoscopic versus open appendicectomy: a non-randomized comparative study

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ABSTRACT

Background: Appendicectomy is one of the most common surgical procedures performed in emergency surgery. Despite this, there is still lack of consensus about the most appropriate technique for appendicectomy. In this longitudinal analysis, we aimed to compare the outcomes of laparoscopic appendicectomy (LA) and the conventional technique or open appendicectomy (OA) in the treatment of acute appendicitis.

Methods: A non-randomized longitudinal comparative study was conducted in NKP Salve Institute of Medical Sciences and Lata Mangeshkar Hospital, Nagpur, India. From November 2017 to October 2019, 53 patients underwent OA and 59 underwent LA, making a total number of patients included in this study to be 112 (n). The two groups were compared for operative time, length of hospital stay, postoperative pain, post-operative ileus and complication rate.

Results: Laparoscopic appendicectomy was associated with a shorter hospital stay (4.34±1.37 days in LA and 5.09±1.71 days in OA, p<0.01), with a lower post operative pain score [VAS] (2.93±0.80 in LA and 4.62±0.92 in OA, p<0.001). Operative time was shorter in the open group (42.70±12.05 min in OA and 43.39±16.59 in LA). Complications were lesser in the LA group with a significantly lower incidence of wound infection (3.4% in LA and 13.2% in OA).

Conclusions: Laparoscopic approach is safe and efficient in appendicectomy and it provides clinically advantages over open method (shorter hospital stays, lower post op pain, early food tolerance, earlier return to work and lesser wound infection) against only marginally longer operative time.

Keywords: Laparoscopic appendicectomy, Open appendicectomy, Appendicitis

INTRODUCTION

Appendicitis is one of the most common intra-abdominal inflammatory conditions requiring emergency surgery, with a lifetime risk of around 8%.1 Appendicectomy is considered as the most frequently performed abdominal surgery.² Historically, the management of this disease has been through open surgery. However, in recent years, this has changed with the introduction of the laparoscopic technique described by Semm in 1983.3 Evidence in literature suggests minimal surgical trauma through

laparoscopic approach resulted in significantly shorter hospital stay, lesser postoperative pain, faster return to daily activities in several settings related with gastrointestinal surgery, besides doubling up as a diagnostic procedure in unconfirmed cases as seen in many young females presenting with right iliac fossa pain.⁴⁻⁶ However, a consensus that establishes the superiority of laparoscopic appendicectomy (LA) versus open appendicectomy (OA) has not yet been reached. Bearing this in mind, we designed the present study to determine any possible benefits of the laparoscopic

approach. The aim of this study was to compare the clinical outcomes (hospital stay, operating time, postoperative complications, and time to oral intake and to resume normal activity) between open appendectomy and laparoscopic appendectomy.

METHODS

Patient selection

This was a non-randomized longitudinal comparative study. From November 2017 to October 2019, 149 patients underwent appendicectomy in our tertiary care centre NKP Salve Institute of Medical Sciences and Lata Mangeshkar Hospital, Hingna, Nagpur, Maharashtra, India. Of these, 112 patients were included in the study, of which 53 (47%) underwent OA and 59 (53%) underwent LA. Rest of the 37 were excluded as were done either by 2 port technique, SILS technique, or found to have perforated appendix on laparotomy. 3 patients had to be converted from laparoscopic to open technique, and were therefore included in OA group.

Inclusion criteria

Inclusion criteria were patients of either sex diagnosed as acute appendicitis clinically or/and on imaging and undergoing conventional open or laparoscopic appendicectomy, with or without a comorbid condition. Patients undergoing interval appendicectomy. Patients above the age of 18 years.

Exclusion criteria

Exclusion criteria were patients below 18 years of age. Laparotomy revealing perforated or gangrenous appendix, requiring appendicectomy. Other methods for appendicectomy including single incision laparoscopic appendicectomy (SILA) and 2 port laparoscopic appendicectomy.

The diagnosis was made clinically with history (right iliac fossa or periumbilical pain, nausea/vomiting, fever), physical examination (tenderness or guarding in right iliac fossa) along with laboratory markers like leucocytosis and neutrophilia. In patients where a clinical diagnosis was uncertain, imaging studies such as abdominal ultrasound or CT were performed.

All operations were performed by a team of one consultant who was experienced in the open as well as laparoscopic approach and two to three residents. Prior to surgery each patient was given intravenous antibiotic treatment consisting of a third-generation cephalosporin and metronidazole. The decision about the type of the operation was made according to the preference and experience of the surgical team on duty.

The patients were divided into two groups. Open appendectomy (OA) group and laparoscopic

appendectomy (LA) group. OA was performed through standard McBurney incision. Muscles were retracted and peritoneum was accessed and opened to deliver the appendix, which was removed in the usual manner.

A standard 3 parts technique was used for laparoscopic group. Pneumoperitoneum was produced by a continuous pressure of 12-14 mmHg of carbon dioxide via either a verres canula or open technique, positioned in infraumbilical site. The patient was placed in a Trendelenburg position, with a slight rotation to the left. The abdominal cavity was inspected in order to exclude other intra-abdominal or pelvic pathology. After the mesoappendix was divided with bipolar forceps, the base of the appendix was secured with two ligating loops of No. 1 vicryl, followed by dissection distal to the second loop. Then, the distal appendicular stump was closed to avoid the risk of enteric or purulent spillage. The specimen was retrieved through a 10 mm infraumbilical port. All specimens were sent for histopathology. The patients were not given oral feed until they were fully recovered from anesthesia and had their bowel sounds returned when clear fluids were started. Soft diet was introduced when the patients tolerated liquid diet and had passed flatus. Patients were discharged once they were able to take regular diet, were afebrile, and had good pain control.

The operative time (minutes) for both the procedures was counted from the skin incision to the last skin stitch applied. The length of hospital stay was determined as the number of nights spent at the hospital postoperatively. Wound infection was defined as redness or purulent or seropurulent discharge from the incision site. Seroma was defined as localized swelling without redness with ooze of clear fluid. Paralytic ileus was defined as failure of bowel sounds to return within 12 hours postoperatively.

The collected clinical data included demographic data, co-morbidities, initial laboratory findings, operation time, intraoperative findings (acute, gangrenous or perforated appendix), post-operative pain, post-operative hospital stay and postoperative complications.

Statistical analysis

The demographic factors were presented as mean, standard deviation, tables and charts. The continuous variables were analyzed using student's t-test and categorical variables by fisher's exact test or chi square test. Linear regression test was applied to explore the relation between two or more variables. The sample size for our study was calculated based on an analysis of sample sizes require for each of the parameters (operative time, length of hospital stay, postoperative pain, complication rate, return to normal activity and cost) for an α =0.05 and a power of 90%. A p value of 0.05 was considered as significant. All calculations were performed by using the SPSS software package version 17.0 (SPSS Inc., Chicago, IL).

Ethics approval

The study was approved by the ethics committee of Lata Mangeshkar Hospital, Nagpur, India. Waiver of informed consent from patients was approved because of the observational nature of the study.

RESULTS

Out of 112 patients with acute appendicitis, 53 patients underwent open appendectomy and 59 patients underwent laparoscopic appendectomy. Demographic data including age, gender and comorbidity were comparable between both the groups without any statistically significant difference (Table 1). Out of the total 53 open procedures, 38 (72%) were performed for uncomplicated appendicitis and 15 (28%) for complicated disease including appendiceal perforation with local or widespread peritonitis. In the laparoscopic group, 43 (73%) procedures involved uncomplicated disease and 16 (27%) complicated appendicitis.

In our study, the mean±SD operative time of 43.39±16.59 minutes for the LA group was only slightly longer than the mean operative time of 42.70±12.05 min for open appendectomy (p=0.803). The laparoscopic group had lower post-operative pain 24 hours after surgery, as evident from the statistically significant difference in VAS scores for pain. Mean VAS score for pain on post op day 1 was 2.93±0.80 for LA group and 4.62±0.92 for OA group (p<0.001). Hence, LA group also required fewer doses of parenteral and oral analgesics in the operative and post-operative periods compared with the open appendectomy. Bowel movements in the first postoperative day were observed in 57% patients subjected to laparoscopic appendectomy and only 19% in the open group (p<0.001).

Table 1: Demographic and preoperative data and its distribution.

Variable	Open appendicectomy (OA) (53)	Laparoscopic appendicectomy (LA) (59)
Age (in years)		
Mean±SD	30.40±9.19	27.56±8.02
Most common		
age group in	18-30 (56.6%)	18-30 (79.7%)
years (%)		
Gender (%)		
Males	66	64.4
Females	34	35.6
Comorbidity	11.3% (6/53)	1.7% (1/59)
Diabetes	3	1
Hypertension	2	0
COPD	1	0

As a result, 83% patients in the laparoscopic group and 62% in the open group were able to tolerate a liquid diet within the first 24 postoperative hours (p<0.001). Hospital stay was significantly shorter in the laparoscopic group with a mean \pm SD of 4.34 \pm 1.37 days compared with 5.09 \pm 1.71 of the open appendectomy group (p=0.015).

We observed a greater overall incidence of complications in open surgery than in laparoscopic surgery. A total of 2 (3.4%) complications occurred in the laparoscopic group while 7 (13.2%) complications occurred in the open appendectomy group. 8 of the total 9 complications were superficial surgical site infections. One patient who had undergone laparoscopic appendicectomy had an intraabdominal abscess, which gradually resolved with antibiotics and intraoperatively placed tube drainage over a span of 11 days.

Table 2: Operative and post-operative clinical data.

Variables	Open appendicectomy (n=53)	Laparoscopic appendicectomy (n=59)	P value		
Intra-operative finding					
Uncomplicated N (%)	38 (71.7)	43 (72.9)			
Complicated N (%)	15 (28.3)	16 (27.1)			
Mean duration of surgery (in mins)	42.70±12.05	43.39±16.59	0.8		
Mean post-operative pain (VAS score out of 10)	4.62±0.92	2.93±0.80	< 0.001		
Mean duration of post-operative ileus (in days)	1.09±0.76	0.53±0.67	0.001		
Length of post-operative hospital stay (in days)	5.09±1.71	4.34±1.37	0.01		
Post-operative complications			0.056		
SSI	7	1	0.050		
Intra-abdominal abscess	0	1			

DISCUSSION

Acute appendicitis is the most common intra-abdominal condition requiring emergency surgery.3 The possibility of appendicitis must be considered in any patient presenting with an acute abdomen, and a certain preoperative diagnosis is still a challenge.⁷ Although more than 35 years have elapsed since the introduction of laparoscopic appendectomy, open appendectomy is still the conventional technique. Some authors consider emergency laparoscopy as a promising tool for the treatment of abdominal emergencies and it is able to decrease overall costs and invasiveness and maximize outcomes and patients' comfort.8,9 Several studies have shown that laparoscopic appendectomy is safe and results in a faster return to normal activities with fewer wound complications. 4,5,10-12 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. 13-16 A recent systematic review of metaanalyses of randomized controlled trials comparing laparoscopic versus open appendectomy concluded that both procedures are safe and effective for the treatment of acute appendicitis.17

The aim of this study was to evaluate the outcome of LA in the treatment of appendicitis in comparison with the open approach. In agreement with other studies we were able to demonstrate that LA is a feasible and safe procedure. ¹⁸

Mean duration of surgery in present study, although slightly longer for laparoscopic appendicectomy (43.39 minutes) than open appendicectomy (42.70 minutes), was comparable in both open and laparoscopic appendicectomy groups, with a p value of 0.803, which was statistically insignificant

Consistent with other studies, our study showed an overall lower post-operative pain in the laparoscopic appendicectomy group with a p value <0.001, which was statistically significant. This is because of the minimal access involved in laparoscopy. Increased post-operative pain in open approach is linked to retraction of the anterior abdominal wall muscles for adequate exposure, which is not the case in laparoscopy. This also translated into a shorter post-operative hospital stay for patients undergoing LA as compared to those undergoing OA.

There were 3 cases of conversion from laparoscopic appendicectomy to open appendicectomy in our study. All these were included in the open appendicectomy group.

Consistent with other studies, SSI (surgical site infection) occurred more often in the OA group (13%) than LA group (3.4%) (p=0.056). The main reasons for the significantly larger number of SSI in the OA group might

be the fact that the inflamed appendix has to be luxated out of the abdomen, which may contribute to contamination of the surrounding tissue. However, during LA the specimen is removed using an endobag.

Furthermore, the laparoscopic approach creates a far smaller operative trauma than does OA. None of the patients had to be re-operated due to SSI, but were manageable with antibiotics and bedside wound treatment.

CONCLUSION

Our results showed the advantages of the laparoscopic approach over open appendectomy including shorter hospital stay, decreased need for postoperative analgesia, early food tolerance, earlier return to work, and lower rate of wound infection, against only marginally higher hospital costs. Furthermore, we found considerable preference of patients (during the collection of consent) for laparoscopy and a high satisfaction after the surgery. Although the incidence of intra-abdominal abscess formation was higher after laparoscopic appendectomy, this catastrophic complication is now rare owing to greater experience of surgeons with laparoscopy and improvements in technique. Provided that surgical experience and equipment are available, laparoscopy could be considered safe and equally efficient compared to open technique and should be undertaken as the initial procedure of choice for most cases of suspected appendicitis.

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Institutional Ethics Committee

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