Original Research Paper

Volume - 12 | Issue - 01 | January - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

General Surgery

A PROSPECTIVE COMPARATIVE STUDY OF OPEN VS LAPAROSCOPIC APPENDICECTOMY

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ABSTRACT To compare laparoscopic and open method of performing appendicectomy with regard to several variables like symptoms at the time of presentation, method of surgery, complications, duration of antibiotic and analgesic treatment, commencement of oral feeds, hospital stay and recovery time.60 patients with appendicitis (acute and recurrent), admitted in the department of General Surgery, KIMS General Hospital from October 2020 to July 2021 were included in the study. The patients were above 10 years of age of both sexes and presented with signs and symptoms of appendicitis. In our study a total of 28 female (OA/LA: 18/10) and 32 male (OA/LA: 12/20) were included. The indication for surgery was pain in the right iliac fossa in 50 patients of our study. Remainder of the patients presented with peri-umbilical or right lumbar pain. In LA,we had a success rate of 100% as no cases were converted to open appendectomy. The mean operating time in our series was LA = 50.16 minutes and OA = 65.80 minutes (p=0.016). The average postoperative hospital stay was 6.6 days (LA) and 9.06 days (OA) (p=0.001). Total recovery time was 24.96 days in OA as compared to 13.93 days with LA.This study shows that in terms of patient comfort, complications and post-operative recovery, laparoscopic appendicectomy is superior to open appendicectomy (p=0.01) and we would recommend that laparoscopy be the procedure of choice in all patients with suspected appendicitis.

KEYWORDS : laparoscopic appendicectomy, appendectomy, laparoscopy, conversion to open

INTRODUCTION

Vermiform appendix is considered a vestigial organ in the human body. Appendicitis, inflammation of this organ, is considered in the differential diagnosis of a patient with acute abdomen; often requiring its immediate surgical removal[1,2]. Appendicectomy is one of the most commonly performed operations by general surgeons. Open method of performing appendectomy has been the gold standard treatment for acute appendicitis. It is considered a safe and effective procedure with low morbidity[3,4]. Laparoscopic appendicectomy was first described by Kurt Semm in 1983. With advances in technology and the surgical technique, laparoscopic appendicectomy has become the novel alternative in the treatment of appendicitis in the last two decades. However, no consensus exists as to whether laparoscopy should be performed in selected patients of as a routine procedure for all patients with suspected acute appendicitis[5, 6].In this study, the outcomes of both surgeries are considered in cases suspected of acute appendicitis and an attempt is made to understand the criteria of selection and morbidity of the surgery performed.

MATERIALS AND METHODS: This study compares laparoscopic and open method of performing appendicectomy with regard to several pre-operative, peri-operative and post-operative variables like symptoms at the time of presentation, method of surgery, complications, duration of antibiotic and analgesic treatment, commencement of oral feeds, hospital stay and recovery time. The aim and objective of this study is to compare the results in 30 cases of laparoscopic appendicectomy and 30 cases of open appendicectomy performed in patients with acute and recurrent appendicitis done in KIMS General Hospital,Amalapuram.

RESULTS:

During October 2020 to September 2021, 60 patients who underwent either open or laparoscopic appendicectomy were randomly selected from the study. 30 cases each of open and laparoscopic appendicectomy were taken up. All these patients were operated at KIMS General Hospital, Konaseema institute of Medical Sciences and Research Foundation The youngest patient in our study was 10/12 years of age and the oldest patients 45/45 years of age, in O.A. and L.A. respectively. In our study a total of 28 female (18 open and 10 of laparoscopy) and 32 male (12 open and 20 laparoscopy) were included. There was no significant difference in the mean age between the two samples. The indication for surgery was pain in the right iliac fossa in 50 patients of our study. Rest of the patients presented with peri-umbilical or right lumbar pain. In laparoscopic appendicectomy, we had a success rate of 100% as no cases were converted to open appendicectomy. The mean operating time in our series was 50.16 minutes by laparoscopy and a mean time of 65.80 minutes in the open cases (p=0.016). The fastest time recorded was 25 minutes in laparoscopic group and 20 minutes in open group and the longest time recorded was 100 minutes in laparoscopic group and 140 minutes in open group. We found that the time taken to perform laparoscopy steadily declined during the course of the study. Repeated fogging of the laparoscopic lens was the most common problem encountered followed by difficulties faced during adhesionolysis, resulting in an increase in the operating time. This was overcome by cleaning the lens of the laparoscopic with normal saline/povidone iodine solution. Adhesionolysis was performed in both the procedures for adhesions.The average number of postoperative hospital stay was 3 days in laparoscopic group and 5 days in open group (p<0.05). The laparoscopic group showed 0.1% (2 patients) wound infection and wound complication rate. Wound infection was defined as any purulence present at the wound site requiring antibiotics. The open group showed a 0.13% (4 patients) wound complication rate, which was defined as a wound site that required dressing or cleansing and antibiotics. A mortality rate of 0% was recorded in both groups. Total recovery time information was collected during follow – up visits which was 24.96 days in open appendicectomy as compared to 13.93 days with laparoscopic appendicectomy (p=0).The data illustrates a marked difference with reduced stay in hospital, shorter duration of post-operative pain, and early return to employment following laparoscopic appendicectomy (p=0.01).

Table – 1 Sex Distribution

	MALE	FEMALE
Open appendicectomy – (OA)	12	18
Laparoscopic Appendicectomy (LA)	20	10

The male to female ratio for OA and LA was 1:1.5 and 2:1 respectively. Among the patients who underwent appendicectomy both (open and laparoscopic), 53.4% were male and 46.6% were female.

Table – 2 Age Distribution Of Patients

Age in years	O.A	L.A
10 – 20	16	6

21 – 30	8	15
31 – 40	4	6
41 – 50	2	2

The age distribution was between 10 and 45 years in both open and laparoscopic appendicectomy cases.

Table – 3 Intra Operative Findings

DIAGNOSIS	O.A	L.A
Inflamed appendix	19	27
Gangrenous appendix	4	0
Perforated appendix	3	1
Normal appendix	4	2
Total	30	30

Table – 4 Time Duration Of The Surgery

TIME TAKEN IN MIN	O.A	L.A
Below mean time	10	18
Above mean time	20	12
Total	30	30

The time duration was recorded from the when the patient received anesthesia to the end of the surgery. Operating time ranged from 25 – 100 min in laparoscopic group and 20 – 140 min in open group with a mean/SD of 50.17/17.39 and 65.81/30.15 respectively. An assessment was made by comparison between the time taken by the operating surgeon below and above the average time for either surgery, emphasizing that laparoscopic appendicectomy was indeed faster to perform and operating time improved with experience of the operating surgeon.

Table – 5 Procedures Done Along With Appendicetcomy

PROCEDURES	O.A	L.A
Deroofing of the ovary	0	2
Cholecystectomy	0	1
Resection and anastomosis	2	0
Salpingectomy	0	1
Total	2	4

Six patients had two concomitant pathology, both of which was operated upon at the same time.

Table – 6 Post Operative Course

	O.A	L.A
Incisional pain	2.9	2.5
Intra muscular analgesia	3.6	3.3
Oral feeds	3	2
Ambulation	2	1.8
Hospital stay	8	7.4
Return to work	20	18

Table – 7 Histopathology

DIAGNOSIS	O.A	L.A
Acute appendicitis (AA)	18	22
Acute exudative appendicitis(AEA)	0	2
Acute on chronic Appendicitis(ACA)	3	4
Suppurative appendicitis with peri Appendicitis(SA)	5	1
Recurrent Appendicitis(RA)	2	0
Normal appendix (NA)	0	1
Meckel's Diverticulum(MD)	2	0
Total	30	30

All specimen collected were sent for histopathology examination and the data from the reports obtained were tabulated. Normal appendix was found in the case of right ectopic pregnancy, and an appendicectomy was subsequently done.

DISCUSSION:

A Russian Gynaecologist, Dr. Issac Ott, invented laparoscopic surgery in 1910. It took decades for General Surgeons to adopt laparoscopy as a diagnostic modality. Those early operations were the first generation of laparoscopic procedures.In the late 1980's high definition televideoscopy was introduced. Laparoscopic appendicectomy was first described by Semm, and was initially limited to incidental appendicectomy performed at the time of gynaeologic laparoscopic laparoscopy or recurrent appendicitis or endometriosis. As familiarity developed, the technique was further refined and indications extended to equivocal cases of appendicitis and finally to known appendicitis.The surgical technique is now well developed and several methods have been described for both ante grade and retrograde appendicectomy. The original technique of Semm most closely mimics the open technique used by most American surgeons.In India the laparoscopic surgery was introduced in early 90's and slowly gained popularity. The proper training, set – up and affordability are the reason for delay for the smaller centers to adopt this surgical modality.The study was conducted at KONASEEMA INSTITUTE OF MEDICAL SCIENCES AND RESEARCH FOUNDATION. The study included 30 cases of laparoscopic and 30 cases of open appendicectomy. In all of our cases we used the infra umbilical incision to insert the laparoscope. The insertion of Veress needle to insufflate had no complication associated with it in our study. After the completion of laparoscopic appendicectomy, the vermiform appendix was grasped with grasping forceps. Surgical site was inspected for bleeding. The appendix was extracted out through the right iliac fossa port. This randomized trial has shown that patient recovery measured by hospital stay is shorter following laparoscopic appendicectomy as compared to open appendicectomy. Postoperative pain was subjectively lesser after laparoscopy. Early ambulation was achieved. Ambulant patients who did not require parenteral analgesia, and tolerated oral feeds were considered fit for discharge. Our study has shown a decrease in hospital stay with laparoscopy. This phase of recovery, although small, is an important factor for relatively younger age group patients because of their economic productivity. The second improved variable is the reduction in postoperative complications. The total number of wound infection for open appendicectomy was four when compared to two cases after laparoscopy. The reduction in wound infection is expected because the appendix is usually brought through the laparoscopic cannula and does not touch the abdominal wound. However, care must be taken to prevent sepsis after operation.. Before the laparoscope was removed the whole peritoneal cavity was inspected for fluid or blood collections which were aspirated. Laparoscopic appendicectomy group showed more rapid recovery to normal activities after discharge from hospital. One of the perceived advantages of laparoscopy is that it reduces the rate of unnecessary appendicectomy which is particularly relevant in the young females. In our study we have closed both 10mm and 5mm ports using 2.0 proline. We have closed the 10 mm ports in two layers. Band- Aid was applied over the sutured site. The conversion from laparoscopic to open surgery is indicated whenever there are intra operative complications, when the anatomy cannot be defined which make the surgery difficult. In our study we had no conversions done making the success rate 100%. Operating time ranged from 25 – 100 min in laparoscopic group and 20 – 140 min in open group with a mean/SD of 50.17/17.39 and 65.81/30.15 respectively. In comparison to studies conducted by Bruwer et al[7] (67.2/27.5, 53.1/25.2), Ignacio et al[8] (77.4/27.1, 66.9/21.6) and Kazemier et al[9] (61/24, 42/18); we had a better result in the time taken to conduct laparoscopic appendicectomy. In our study we found the reintroduction of oral feeds in days [LA (mean/sd); OA (mean/sd)] was [(2/0.59); (2.84/0.89)] as compared to study by Kazemier et al[9][(1.3/0.2);(1.4/0.3)]. Hospital stay in days in our study was [(3/2.16); (5/3.26)] as compared to studies by Bruwer et al[8] [(3/1.6);(3.7/1.1)], Ignacio et al[33] [(0.9/0.78);(1.21/0.69)] and Kazemier et al[9] [(3.7/2.5);(4.4/3.9)]. Return to work by patients was [(13.93/4.82); (24.97/10.91)] as compared to study by Bruwer et al[7][(13.6/5.9); (15.8/7.6)].Most of our patients after laparoscopic appendicectomy did not require injectable analgesics after 2 days as compared to patients who underwent open appendicectomy who required analgesics for 3 to 5 days. In the patients with abscess or perforation the advantage of LA was however lost, in both the cases of LA and OA with abscess or perforation total hospital duration of stay has been increased, but we observed rate of complications of wound infections and also duration of the stay is higher in OA group, as midline incision may be required in this group. With the increase in laparoscopic skills the need for conversion to the open has been reduced or almost nil in recent years. Laparoscopic appendicectomy was observed to be associated with the reduction in morbidity in all the obese patients and length of stay is mean 1.2 days shorter than the open appendicectomy group.

We have noted several pitfalls and difficulties in laparoscopic appendicectomy:

1. If the patient is positioned on the operating table with arms abducted it will be difficult for the first assistant and camera operator to stand comfortably. The arms should be tucked at the patient's side.
2. Placement of the trocars too close to each other will make it

difficult for the surgeon and first assistant to work together without interference.

This is most likely to be a problem in small stature and thin patients.A very long appendix may be difficult to retract. Such an appendix must be grasped closer to the base and the tip should be allowed to dangle, so that the base of the appendix at the caecum can be accurately identified.The group from USC led by Dr. Katkhouda [10] published on September 2005 has carried out an outstanding study comparing open versus laparoscopic techniques for appendectomy. Merits of the study include its randomized blinded design, the small and homogeneous group of well-trained surgeons participating in the study, the comprehensive in-hospital and post-discharge analysis and assessment, and the intent to treat statistical analysis, which is the most stringent and meaningful of all. There was no mortality. The overall complication rate was similar in both groups (18.5% versus 17% in the laparoscopic and open groups respectively), but some early complications in the laparoscopic group required a reoperation. Operating time was significantly longer in the laparoscopic group (80 minutes versus 60 minutes; $P = 0.000$) while there was no difference in the pain scores and medications, resumption of diet, length of stay, or activity scores. At 2 weeks, there was no difference in the activity or pain scores, but physical health and general scores on the short-form 36 (SF36) quality of life assessment forms were significantly better in the laparoscopic group. Appendectomy for acute or complicated (perforated and gangrenous) appendicitis had similar complication rates, regardless of the technique ($P = 0.181$). Number one, although the number of complications did not differ among the groups, life-threatening complications requiring reoperation occurred only in the laparoscopically treated group, this study also pointed out that Most laparoscopic approaches have gained acceptance because of decreased length of stay, decreased time to recovery, faster return to work, and decreased analgesic requirements. These parameters were not different in the appendectomy study that we carried out. Another study of meta-analysis by Xiaohang Li [11] and his group comparing LA and OA in adults and in children showed results similar to our study. Forty-four randomized controlled trials with 5292 patients were included in the meta-analysis. Operating time was 12.35 min longer for LA (95% CI: 7.99 to 16.72, $p < 0.00001$). Hospital stay after LA was 0.60 days shorter (95% CI: -0.85 to -0.36, $p < 0.00001$). Patients returned to their normal activity 4.52 days earlier after LA (95% CI: -5.95 to -3.10, $p < 0.00001$), and resumed their diet 0.34 days earlier (95% CI: -0.46 to -0.21, $p < 0.00001$). Pain after LA on the first postoperative day was significantly less ($p = 0.008$).The overall conversion rate from LA to OA was 9.51%. With regard to the rate of complications, wound infection after LA was definitely reduced (OR = 0.45, 95% CI: 0.34 to 0.59, $p < 0.00001$), while postoperative ileus was not significantly reduced (OR = 0.91, 95% CI: 0.57 to 1.47, $p = 0.71$).However, intra-abdominal abscess (IAA), intraoperative bleeding and urinary tract infection (UIT) after LA, occurred slightly more frequently(OR = 1.56, 95% CI: 1.01 to 2.43, $p = 0.05$; OR = 1.56, 95% CI: 0.54 to 4.48, $p = 0.41$; OR = 1.76, 95% CI: 0.58 to 5.29, $p = 0.32$). LA provides considerable benefits over OA, including a shorter length of hospital stay, less postoperative pain, earlier postoperative recovery, and a lower complication rate. Furthermore, over the study period it was obvious that there had been a trend toward fewer differences in operating time for the two procedures. Although LA was associated with a slight increase in the incidence of intraoperative bleeding , it is a safe procedure. It may be that the widespread use of LA is due to its better therapeutic effect. It appears that laparoscopic appendicectomy has assumed an important place among the techniques used by the general surgeon. Its safety and efficiency have been well demonstrated. Pain, infection and prolonged convalescence – inherent problems with any abdominal incision- can be decreased. A thorough abdominal exploration can be performed laparoscopically. The Laparoscopic technique is more cosmetically acceptable by the patient. It is our belief that the many advantages of laparoscopic appendicectomy will soon make it the procedure of choice. The exposure and experience not only reduces the complications but also reduces the conversion rate. The mean operating time, which can be slightly more than the open method, is insignificant compared to the other advantages mentioned above with laparoscopic appendicectomy[7-9].

CONCLUSION

Laparoscopy has long been a standard form of investigation and treatment in gynecology but has only recently been introduced as a mode of operation in general surgery[12].It appears that laparoscopic appendicectomy has assumed an important place among the techniques used by the general surgeon. Its safety and efficiency have been well demonstrated. Pain, infection and prolonged convalescence – inherent problems with any abdominal incision- can be decreased. A thorough abdominal exploration can be performed laparoscopically. The Laparoscopic technique is more cosmetically acceptable by the patient. It is our belief that the many advantages of laparoscopic appendicectomy will soon make it the procedure of choice.In our study of laparoscopic versus open appendicectomy which consisted of 30 patients each, majority of whom were from middle and low socio-economic status, it has been shown that the laparoscopic appendicectomy is a feasible and also safe surgery with good and definite advantages over the open method as far as postoperative pain, recovery, wound complications and hospital stay is concerned. The exposure and experience not only reduces the complications but also reduces the conversion rate. The mean operating time, which can be slightly more than the open method, is insignificant compared to the other advantages mentioned above with laparoscopic appendicectomy.

In our study we have observed the following:

1. Laparoscopic appendicectomy is a safe and feasible procedure.
2. Patient acceptance and compliance are excellent factors that are essential in the prevailing socio – economic condition.
3. The procedure allows adequate exposure with minimum invasiveness and the complications are minimal in experienced hands.
4. Even through the mean operating time is marginally less than the open appendicectomy, the postoperative pain is less, the recovery is faster and hence the mean hospital stay is reduced.
5. Patient returns home and attends to his daily work much earlier compared to open appendicectomy.
6. The incidence of wound infection is low, scar is minimal and hence the cosmetic demand of the patient is satisfied.
7. The conversion rate can be reduced and good success rate can be achieved with more exposure and experience.

In conclusion, this study shows that in terms of patient comfort, complications and post- operative recovery, laparoscopic appendicectomy is superior to open appendicectomy ($p=0.01$) and we would recommend that laparoscopy be the procedure of choice in all patients with suspected appendicitis.

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