

Hospital Based Retrospective Comparative Study Assessing Effectiveness of Laparoscopic Appendectomy Over Open Appendectomy

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Received: 13-04-2024 / Revised: 10-05-2024 / Accepted: 24-06-2024

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Conflict of interest: Nil

Abstract:

Aim: The aim of this study was to validate the pros of laparoscopic appendectomy (LA) over open appendectomy (OA) and to compare various primary outcome measures in the management of acute and recurrent appendicitis.

Methods: The present study was conducted in the Department of General Surgery, PMCH, Patna, Bihar, India. A study was carried out on 100 patients were admitted with 50 patients undergoing laparoscopic appendectomy and the remaining 50 patients undergoing open appendectomy. In both study groups the outcome was assessed based on the intra operative finding, operative time, post-operative recovery, post-operative complication, and length of hospital stay.

Results: In the study, 21 cases (42%) below 20 years, 13 cases (26%) between 21 and 30 years, 8 cases (16%) between 31 and 40 years and 8 cases (16%) between 41 and 50 years underwent laparoscopic appendectomy. 12 cases (24%) below 20 years, 19 cases (38%) between 21 and 30 years, 3 cases (6%) between 31 and 40 years and 16 cases (32%) between 41 and 50 years underwent open appendectomy. In the study, 32 (64%) males and 18 (36%) females underwent laparoscopic appendectomy. 34 (68%) males and 16 (32%) females underwent open appendectomy. In the study, 43 (86%) patients in the laparoscopic group and 47 (94%) patients in the open group had differential count. In the study, 36 (72%) patients in laparoscopic and 34 (68%) patients in open group had inflamed appendix in USG. The mean score for duration of time of surgery was 34.16 minutes in the laparoscopic group and 18.2 minutes in the open group. The difference was significant $p < 0.0001$. The mean pain score difference was significant ($p < 0.0001$).

Conclusion: On analysing the data, we found a definite difference in outcome between open and laparoscopic appendectomy in consecutively selected patients. The laparoscopic appendectomy was better than the open appendectomy with respect to pain score, lesser use of analgesics, post operative complications like vomiting, ileus and wound infection rate.

Keywords: Open appendectomy, Laparoscopic appendectomy, Hospital cost, Appendicitis.

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Introduction

Appendicitis is the most common cause of surgical abdomen in all age groups.[1,2] Approximately 7–10 % of the general population develops acute appendicitis with the maximal incidence being in the second and third decades of life.[3] Appendicitis is one of the most common surgical emergencies requiring appendectomy, with a life-time risk of 6%. The overall mortality rate for open appendectomy (OA) is around 0.3% and morbidity about 11%.[4] The diagnosis of Acute Appendicitis (AA) was based on clinical signs and symptoms before the advent of widespread use of sonography and CT scans. Several diagnostic scoring systems such as Alvarado score, Air-Appendicitis inflammatory Response (Andersson score), World Society of Emergency Surgery (WSES) AA grading system have been described.[5]

OA was considered safe, effective, and standard modality of treatment in appendicitis for almost a century. Though easy to perform, OA had a plethora of drawbacks due to variability in the inflammatory process and position of appendix, increased postoperative pain, prolonged hospital stays, delayed return to normal activities, wound- and scar-related complications, and inability to visualize the concomitant pathologies. Open appendectomy has been the gold standard for treating patients with acute appendicitis for more than a century, but the efficiency and superiority of laparoscopic approach compared to the open technique is the subject of much debate nowadays.[3,6,7] With the advent of minimally invasive surgery (MIS), laparoscopic cholecystectomy gained immense popularity for the management of symptomatic gallstone disease; however, it was not the same case with laparoscopic

appendectomy (LA). Encouraged by the success of laparoscopic cholecystectomy, which has become the gold-standard treatment for gallstone disease in a short span of time, laparoscopic surgery has gained in popularity and found application in almost every surgical specialty.

Laparoscopic appendectomy has been shown to be feasible and safe in randomized comparisons with open appendectomy. Laparoscopic appendectomy has improved diagnostic accuracy along with advantages in terms of fewer wound infections,[8] less pain, [8,9] faster recovery and earlier return to normal activity.[8-10] Laparoscopic appendectomy gives a better evaluation of the peritoneal cavity than that obtained by open approach and also facilitates other differential diagnosis.[11] Advantages of laparoscopic approach include less operative time, less postoperative pain, reduced analgesia and less surgery related complications, shorter hospital stay, faster recovery, reduced wound infection, and minimal scarring. On the contrary, laparoscopic appendectomy consumes more operating time 8,9 and is associated with increased hospital costs.[10] The laparoscopic approach has been supported as an alternate to open appendectomy by many comparative studies.[12] Some studies failed to demonstrate clear advantages for laparoscopic over open appendectomy.[12,13]

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

Materials & Methods

The present study was conducted in the Department of General Surgery, PMCH, Patna, Bihar, India from January 2020 to December 2021. A study was carried out on 100 patients were admitted with 50 patients undergoing laparoscopic appendectomy and the remaining 50 patients undergoing open appendectomy. In both study groups the outcome was assessed based on the intra operative finding, operative time, post-operative recovery, post-operative complication, and length of hospital stay.

Inclusion Criteria

- Age >18 years
- Irrespective of sex
- Patients with clinical diagnosis of acute or recurrent appendicitis
- Emergency as well as elective cases posted for appendectomy
- Patients willing to participate in the study

Exclusion Criteria

- Age <18 years

- Pregnant women
- Patients with severe medical co-morbidities (hemodynamic instability, chronic medical or psychiatric illness, cirrhosis, coagulation disorders) requiring intensive care
- Patients with any pathology other than appendicitis recognized per-operatively
- Patients with laparoscopic converted to open.
- Patients not willing to participate in the study

Method of Collection of Data

A prospective observational study was planned in Department of General surgery Patients presenting with pain abdomen and pain in the right iliac fossa were admitted in surgery ward.

They were evaluated with history, clinical examination on the basis of inclusion and exclusion criteria. Routine workup investigations and appropriate radiological investigations like Ultrasonography of abdomen were done in all patients. Most cases were diagnosed based on clinical features and ultrasonographic evidence of appendicular mass. Specific investigation like CECT (contrast enhanced CT scan) abdomen was done only in distinguishing those patients who presented late in their clinical course to demonstrate the ruptured appendix and also to rule out other differential diagnosis of right iliac fossa mass like ileocecal tuberculosis, intussusception, carcinoma caecum etc. Patients and relatives were discussed in detail about the management plan. They were explained about merits and demerits of surgical approach.

A prior informed written consent was taken from patient and relatives before randomizing them into two groups. Patients were asked to pick an envelope to categorize into two study groups. The patients with even number token were included under group-I who were taken for open appendectomy and group-II who were taken for laparoscopic appendectomy. In both study groups the outcome was assessed based on the intra operative finding, operative time, post-operative recovery, post-operative complication, and length of hospital stay. All the relevant data was collected in the performa designed for the study. The data regarding patient profile, diagnosis, investigations, and surgical procedures were collected in a performa and transferred to a master chart in Microsoft Excel sheet.

Statistical Analysis

Presented proforma was used to collect the relevant information, and chi-square test and student t-test, were used for analysis. IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA) software program was used for statistical calculations. If $p < 0.005$ it was considered statistically significant.

Results

Table 1: Age and gender distribution

Variables	Laparoscopy		Open		χ^2 test	P value
	N	%	N	%		
Age (years)						
<20	21	42	12	24	2.68	0.01
21-30	13	26	19	38		
31-40	8	16	3	6		
41-50	8	16	16	32		
Total	50	100	50	100		
Sex						
Male	32	64	34	68	3.14	0.01
Female	18	36	16	32		
Total	50	100	50	100		

In the study, 21 cases (42%) below 20 years, 13 cases (26%) between 21 and 30 years, 8 cases (16%) between 31 and 40 years and 8 cases (16%) between 41 and 50 years underwent laparoscopic appendectomy. 12 cases (24%) below 20 years, 19 cases (38%) between 21 and 30 years, 3 cases (6%)

between 31 and 40 years and 16 cases (32%) between 41 and 50 years underwent open appendectomy. In the study, 32 (64%) males and 18 (36%) females underwent laparoscopic appendectomy. 34 (68%) males and 16 (32%) females underwent open appendectomy.

Table 2: Differential count, ultrasound findings and duration of surgery

Variables	Laparoscopy		Open		χ^2 test	P value
	N	%	N	%		
DC						
Absent	7	14	3	6	0.48	0.01
Present	43	86	47	94		
USG						
Absent	14	28	16	32	0.07	0.01
Present	36	72	34	68		
Duration of surgery Mean±SD						
	34.16±10.12		18.2±6.4		0.0001	

In the study, 43 (86%) patients in the laparoscopic group and 47 (94%) patients in the open group had differential count. In the study, 36 (72%) patients in laparoscopic and 34 (68%) patients in open group

had inflamed appendix in USG. The mean score for duration of time of surgery was 34.16 minutes in the laparoscopic group and 18.2 minutes in the open group. The difference was significant $p < 0.0001$.

Table 3: Post operative pain

Pain	Laparoscopy		Open		Chi square test	P value
	N	%	N	%		
I	34	68	0	0	36.4	0.0001
II	16	32	8	16		
III	0	0	16	32		
IV	0	0	26	52		
Total	50	100	50	100		

The mean pain score difference was significant ($p < 0.0001$).

Table 4: Postoperative time taken to return to the work

Return to work	Type of surgery	N	Mean (days)	Std. deviation	Std. error mean	T value	P value
	Lap	50	9.31	2.628	0.314	10.412	0.0001
	Open	50	14.16	2.858	0.618		

The mean score return to work was 9.31 days in laparoscopic and 14.16 days in open group. The difference was significant $p < 0.0001$.

Table 5: Outcome

Outcome	Laparoscopy		Open		Chi square test	P value
	N	%	N	%		
Unsatisfied	0	0	9	18	38.2	0.0001
Equal	2	1	12	24		
Satisfied	248	96	29	58		
Total	50	100	50	100		

In the study, outcome difference was found to be significant (0.001).

Discussion

Acute abdomen is the most common surgical clinical entity.[14] Acute appendicitis is the most common intra-abdominal condition requiring emergency surgery and carries a life time risk of 6% to 7%.[15] The incidence of acute appendicitis is highest in the second and third decades of life, but the condition occurs in all age groups. Appendectomy is the most commonly performed surgery and accounts for about 6% of all the surgical procedures in the world. The risk of developing appendicitis through the life time is approximately 8.6% for male and 6.7% for females. Appendectomy is the treatment of choice for acute appendicitis. It can be done either by open or laparoscopic method. For more than a century, open appendectomy remained the gold standard for the treatment of acute appendicitis. The introduction of laparoscopic surgery has dramatically changed the field of surgery.[16] It is now time to recommend this minimal access technique in treatment of acute appendicitis. Laparoscopic appendectomy gives a better evaluation of the peritoneal cavity than that obtained by open approach and also facilitates other differential diagnosis.[17]

Laparoscopic surgery is a major surgical advance that has enabled the general surgeon to stretch his hands in superspeciality era.[18] The controversy that currently exists over the potential benefits of laparoscopic appendectomy motivated us to analyse our experience with this procedure.[19] The relative advantages of laparoscopic and open appendectomy are measured primarily in terms of post operative pain score and duration of analgesics used in days. In the study, 21 cases (42%) below 20 years, 13 cases (26%) between 21 and 30 years, 8 cases (16%) between 31 and 40 years and 8 cases (16%) between 41 and 50 years underwent laparoscopic appendectomy. 12 cases (24%) below 20 years, 19 cases (38%) between 21 and 30 years, 3 cases (6%) between 31 and 40 years and 16 cases (32%) between 41 and 50 years underwent open appendectomy. This finding was comparable with the study of Biondi et al[20] where the mean age was 29.66 years in group-I and in group-II the mean age was 27.75. In the study, 32 (64%) males and 18 (36%) females underwent laparoscopic appendectomy. 34 (68%) males and 16 (32%) females underwent open appendectomy.

In the study, 43 (86%) patients in the laparoscopic group and 47 (94%) patients in the open group had differential count. In the study, 36 (72%) patients in laparoscopic and 34 (68%) patients in open group had inflamed appendix in USG. The mean score for duration of time of surgery was 34.16 minutes in the laparoscopic group and 18.2 minutes in the open group. The difference was significant $p < 0.0001$. The results are comparable with the study conducted by Biondi et al [20] in their study the mean duration of hospital stay was 2.7 days in group-I and 1.4 days in group-II. The mean pain score difference was significant ($p < 0.0001$). The mean score return to work was 9.31 days in laparoscopic and 14.16 days in open group. The difference was significant $p < 0.0001$. In the study, outcome difference was found to be significant (0.001). A recent systematic review of meta-analyses of randomised controlled trials comparing laparoscopic versus open appendectomy concluded that both procedures are safe and effective for the treatment of acute appendicitis.[21]

100 appendicitis patients were studied by Mehta et al[22] during 2016-2017 out of which 55% LA and 60% OA cases had inflamed appendix, 25% LA and 20% OA had adhesions, 2.5% LA and 5% OA had appendicular lump, 12.5% LA and 6.76% had OA had distended appendix, 10% LA and 8.3% OA had appendicular perforation while the rest were normal.[23] Post-op complications were studied by G. Kumar in 200 cases. 20% and 10% OA and LA cases respectively had vomiting. Abdominal abscess was found to be a complication in 5% OA cases while no such complication had occurred in LA cases. Wound infection occurred in 17% open and 4% of laparoscopic cases. Ileus was found in both but was less in laparoscopic group.[24] 820 appendectomies were analyzed over a period of 5 years by Senapati et al.[25] In the laparoscopic group, injury to inferior epigastric artery due to trocar occurred in 2 cases while in 13 cases, the approach became difficult due to dense adhesions and was subsequently converted to open. 21 cases reported with surgical site infection amongst the open group. 6 cases reported with surgical site hernia amongst open cases and 2 laparoscopic cases presented with umbilical port hernia.

Conclusion

On analysing the data, we found a definite difference in outcome between open and laparoscopic appendectomy in consecutively selected patients. The laparoscopic appendectomy was better than the open appendectomy with respect to pain score, lesser use of analgesics, post operative complications like vomiting, ileus and wound infection rate. Post operative recovery was good in respect with duration of hospital stay, return to normal work. Overall laparoscopic appendectomy is better than open appendectomy in selected patients with acute or recurrent appendicitis.

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