

Original Research Article

A comparative study of laparoscopic appendectomy versus open appendectomy

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ABSTRACT

Background: Obstruction of appendiceal lumen resulting in acute appendicitis is diagnosed by clinical examination, supported by raised neutrophil count, computed tomography and/or ultrasonography. Appendectomy one of the most commonly done surgeries is the standard line of management for acute appendicitis. Trend is towards greater utilization of laparoscopic appendectomy despite lack of consensus on superiority of laparoscopic procedure, hence imperative to prove scientifically the effectiveness of the two methods. The aim of the present study was a comparative study of laparoscopic appendectomy versus open appendectomy.

Methods: A prospective cohort study of 100 cases of acute appendicitis above 16 years of age with no co morbidities was carried out in Dr. D. Y. Patil Medical College, Hospital and Research Centre from July 2017 to September 2019.

Results: Mean age was 28.82 years, 64 (64%) males and 36 (36%) females, pain in abdomen (100%) being most common complaint followed by fever (77%) with positive correlation with severity of appendicitis (Alvarado score) and with total leukocyte count. Mean duration of surgery and hospital stay in laparoscopic appendectomy was lesser than open and difference was statistically highly significant ($p=0.000$). No difference in pain score observed. Retrocaecal (58%) was the most common position, slightly higher rate of complications in open appendectomy, no conversion of laparoscopic to open. Subjective level of satisfaction score (0-10) in laparoscopic appendectomy was higher than in open and difference was statistically highly significant ($p=0.000$).

Conclusions: Laparoscopic appendectomy had advantages like better cosmesis, shorter duration of procedure and hospital stay, fewer post-operative complications and early return to work with disadvantage of steep learning curve, while open appendectomy, does not require special instruments, and is performed under direct three-dimensional vision.

Keywords: Acute appendicitis, Open appendectomy, Laparoscopic appendectomy

INTRODUCTION

In 1522, da Carpi described for the first time, the structure of appendix and Fallopio compared it with a worm.¹ Appendicitis commonly presents with abdominal pain, fever, nausea and vomiting, although 40% of the patients lack this typical presentation.²

Acute appendicitis occurs due to obstruction of the appendiceal lumen.^{3,4} And is mostly due to fecolith or due to foreign body, worms, trauma etc.^{5,6} Diagnosis of appendicitis is mainly by clinical examination, supported by raised neutrophil count in blood. Since, other infective abdominal conditions can also give rise to elevated white blood cell count, raised WBC is not the only indicator of

appendicitis due to its low sensitivity and specificity.⁷ computed tomography scan is more sensitive (94%) and specific (95%) than ultrasonography (86%, 81% respectively) for its diagnosis.⁸ The Alvarado score is useful but not accurate.⁹ Appendicitis mostly occurs between 5-40 years of age with a median of 28 years.¹⁰ Males, higher socioeconomic status and rural population have been found to have a greater incidence of appendicitis.¹¹ It is one of the most common diagnoses in emergency department. In January 2013-2014, out of 510 patients, admitted in the department of general surgery in a tertiary hospital of Jalgaon district in Maharashtra, 110 were diagnosed of appendicitis. Antibiotics are safe and effective in uncomplicated appendicitis. 26% of the people had recurrence within a year and eventually required an appendectomy. In patients with appendicolith antibiotics are not very effective. Surgery is the standard line of management for acute appendicitis. 11 years old boy, case of perforated appendix within the inguinal hernial sac was the first to undergo appendectomy, which was performed by a French surgeon, Claudius Amyand at St. George's Hospital in London on December 6, 1735. Kurt Semm was the first to perform laparoscopic appendectomy on September 13, 1980. Laparoscopic appendectomy has been found to be a safe and an efficient procedure with added benefits of shorter hospital stay, fewer rates of wound infection and decreased need for post-operative analgesia. After surgical treatment most of the patients show an uneventful recovery, with complications occurring due to delay in the definitive management.

Aim

The aim was a comparative study of laparoscopic appendectomy versus open appendectomy and the objective was to compare the techniques of both procedures, their effectiveness, complications, indications and contraindications, advantage of laparoscopic over open method and conversion rate.

METHODS

A prospective cohort study was carried out in our hospital from July 2017 to September 2019, with a sample size of 100 cases of acute appendicitis above 16 years of age without co morbidities. The purpose of the study explained to patients. Informed written consents were taken prior to actual participation of patient into the study, patient information sheet and informed consent form includes all necessary information to conduct the study.

Thorough history was taken, all patients were clinically examined and findings recorded. Patient autonomy was maintained and random allocation was done to the two groups, one of laparoscopy and the other of open. Expenses for both procedures were borne by the patient along with the medications which was borne by the hospital. Institute Ethical committee approval was taken

prior to the study and consent of patients was taken only after giving full information about study. Patients were assured of his/her reports were kept confidential.

All patients were kept nil by mouth overnight, prior to surgery and were given antibiotic prophylactically. All patients were asked to empty urinary bladder prior to surgery and nasogastric tube (Ryle's tube) was inserted if necessary. All laparoscopic surgeries were performed under general anaesthesia and open appendectomies under spinal anaesthesia, by the same surgical team, intra operative findings and post-operative data were all recorded. Patients asked to follow up in outpatient department. 1 week, 2 weeks and 12 weeks after surgery, or in between if needed. Patients were allowed to leave the study anytime during the course of study if he/she wished to do so.

RESULTS

Mean age of study sample was 28.82 years with standard deviation of 8.43 years, with the highest 65 years and lowest 17 years. There were 64 (64%) males and 36 (36%) females in the study. 44 (44%) samples were from 21-30 years age group followed by 35 (35%) subjects in 31-40 years age group.

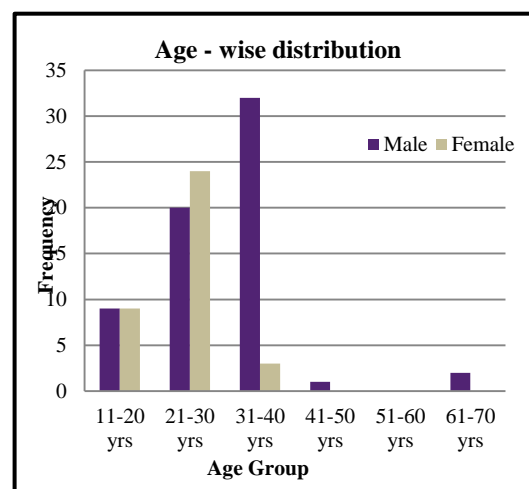


Figure 1: Age wise distribution of study sample.

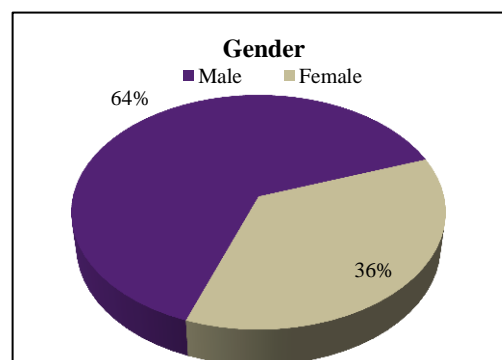


Figure 2: Gender wise distribution of study sample.

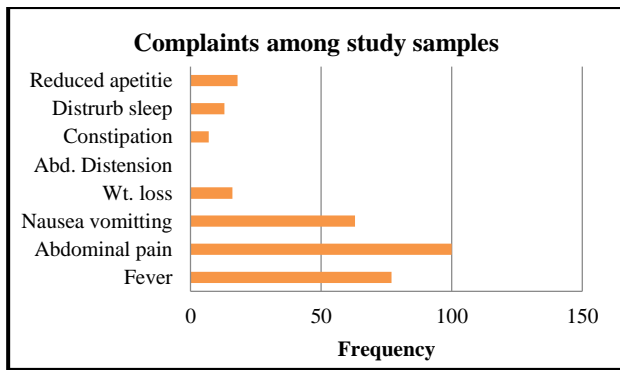


Figure 3: Complaints among study sample.

Abdominal pain was the most common complaint and was present in all 100 (100%) subjects followed by fever in 77 (77%) subjects, nausea and/or vomiting in 63 (63%) subjects. Other complaints like weight loss, constipation, abdominal distension, sleep disturbance, etc., were also noted among study samples.

All 100 subjects had localised pain, of sudden onset among 55, dull aching in 49. 38 subjects had pain since 2 days followed by 35 subjects with complaints of pain since 1 day.

General and systemic examination

68 subjects had good general condition; none of them had pallor, icterus, cyanosis, clubbing, oedema or lymphadenopathy. 82 with body mass index within the normal range while 12 were pre-obese.

55 subjects had flat abdomen followed by 36 with scaphoid. 3 subjects showing striae, there were no engorged veins, visible peristalsis, or pigmentation etc. among study subjects. All hernial orifices were normal for all subjects.

17 subjects had guarding and/or rigidity and 12 had rebound tenderness. No subject had organomegaly or free fluid in the abdomen or local rise of temperature, etc. Normal bowel sounds on auscultation among all subjects.

Severity of appendicitis and total leukocyte count

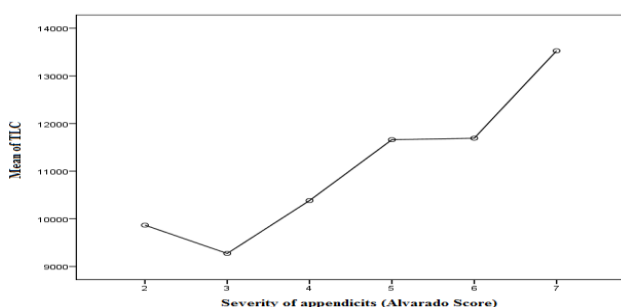


Figure 4: Severity of appendicitis and total leukocyte count.

Figure 4 shows that as severity of appendicitis (Alvarado score) increases total leucocytes count increases among study subjects. (Spearman's rho=0.714; p=0.00) ().

Duration of surgery (min)

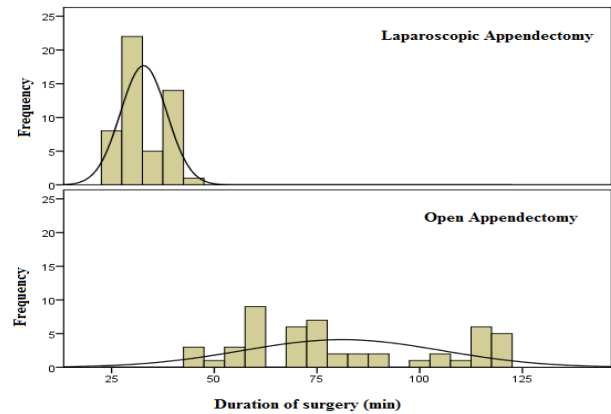


Figure 5: Duration of surgery (in min).

On application of unpaired t test shows that, mean duration of surgery time (min) in laparoscopic appendectomy was lower than open appendectomy and difference was statistically highly significant (p=0.000).

Duration of hospital stay (days)

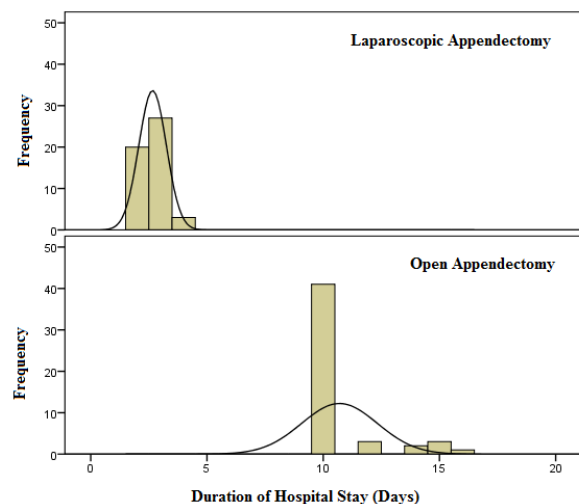


Figure 6: Duration of hospital stay (in days).

On application of unpaired t test shows that, mean duration of hospital stay (days) in laparoscopic appendectomy was lower than open appendectomy and difference was statistically highly significant (p=0.000).

Pain score after surgery

On application of Mann-Whitney U test, not a significant difference in pain score was noted among subjects who underwent laparoscopic appendectomy and those who underwent open appendectomy (p=0.549).

Position of appendix

Retrocaecal (58%) was the most common position of appendix found during surgery, followed by preileal (34%) and pelvic (8%).

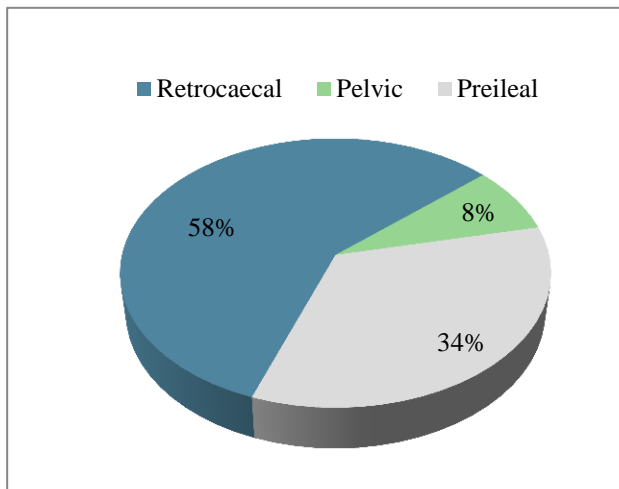


Figure 7: Position of appendix.

Table 1: Complications, conversion and mortality.

Complications	Laparoscopic surgery	Open surgery
Fever	4	6
Seroma	0	5
Wound Gape	0	2
Nil	46	37
Total	50	50

Higher post-operative complications were recorded among subjects that underwent open appendectomy like fever, seroma and wound gape than the laparoscopic appendectomy group. Intra operative complications like bleeding, adhesions, etc., were observed in both groups. No subject operated via laparoscopic method needed conversion to open appendectomy. No mortality was reported.

Resume daily work after surgery (in days)

On application of unpaired t test shows that, mean duration to resume to daily activities (days) in laparoscopic appendectomy was lower than open appendectomy and the difference was statistically highly significant ($p=0.000$).

Patient satisfaction level (subjective)

On application of Mann-Whitney U test, subjective level of satisfaction score (0-10) in laparoscopic appendectomy was higher than open appendectomy and the difference was statistically highly significant ($p=0.000$), it could be due to lower duration of surgery, shorter hospital stay,

early resume to routine, fewer complications in the post-operative period and better cosmetic outcome among laparoscopic appendectomy group.

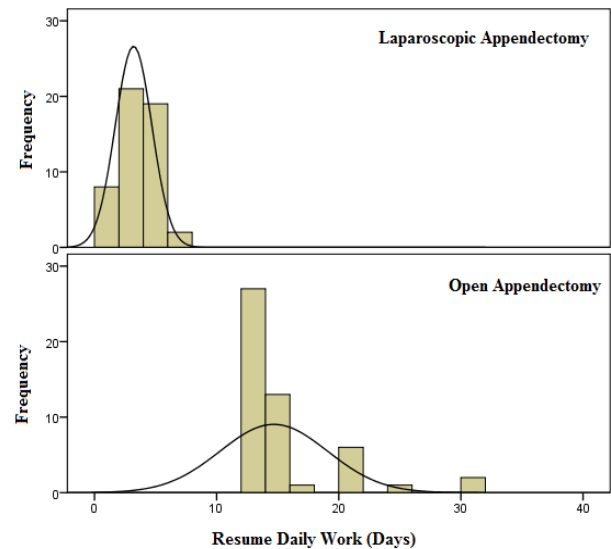


Figure 8: Resume daily work after surgery (days).

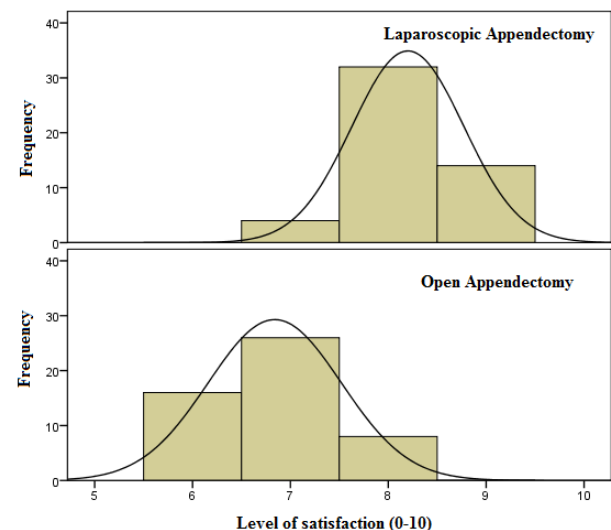


Figure 9: Patient satisfaction level (subjective).

DISCUSSION

Age-gender distribution

The mean age of study sample was 28.82 years with SD of 8.43 years. 44 (44%) samples belonged to 21-30 years of age; similarly highest (34.54%) subjects were from same group in Chaudhari et al.¹⁵ In this study, the patients undergoing treatment for appendicitis were in the 17-65 years age group. This suggests that though most of the subjects were of younger age groups, appendicitis is not uncommon in elderly.

There were 64 (64%) males and 36 (36%) females in the study, sex ratio was 1.77:1 slightly lower than 1.96:1 in Mishra, Goel et al and higher than 1:1.36 in Ekka et al which suggests that appendicitis affects both the genders equally.^{26,28}

Clinical presentation

Abdominal pain was the most common complaint and it was present in all 100 (100%) subjects followed by fever in 77 (77%) subjects, Babu, Savitha reported fever in 81% after abdominal pain.²⁷ Abdominal pain followed by anorexia in 87% and nausea/vomiting in 76% of cases reported by Mishra, Goel et al.²⁶ Ekka et al Chaudhari et al also reported abdominal pain as the most common presentation of appendicitis.^{15,28} 17% with guarding and/or rigidity and 12% with rebound tenderness which was less in comparison with Mishra, Goel et al 97% and 59% respectively.²⁶

Position of appendix

Retrocaecal (58%) was the commonest position of appendix found during surgery, while it was 46% in R Mishra, Goel et al.²⁶

Duration of operation

Mean duration of surgery time (min) in laparoscopic appendectomy (32.8) was lower than open appendectomy (81.1) and the difference was statistically highly significant ($p=0.000$).

Similarly, shorter duration of operation in laparoscopic appendectomy than open appendectomy was observed by Aziz, Athanasiou et al in their meta-analysis comparing both methods.⁴⁵

Duration of hospital stay

Duration of hospital stay (days) in laparoscopic appendectomy (2.6) was lower than in open appendectomy (10.7) and the difference was statistically highly significant ($p=0.000$), similarly Utpal reported shorter hospital stay in laparoscopic appendectomy (median 3 days) in comparison with open (median 5 days).³² Rashid, Nazir et al, Wang, Dong et al, Shuai, Aziz, Athanasiou et al had a shorter hospital stay in laparoscopically operated group while no difference was observed by Katkhouda, Mason et al in their study.^{33,40,44,45,46}

Resume daily work after surgery

Mean duration to resume to daily work (days) in laparoscopic appendectomy (3.2) was lower than in open appendectomy (14.6) and the difference was statistically highly significant ($p=0.000$), similar observations were made in Utpal and Rashid, Nazir et al.^{32,33}

Pain score

Pain score after surgery in laparoscopic appendectomy group was not significantly different than open appendectomy group ($p=0.549$), similar observation was found in Katkhouda, Mason et al.⁴⁶ Jaschinski, Mosch, Eikermann et al and Rashid, Nazir et al found pain score following laparoscopic appendectomy to be lower as compared to open appendectomy.^{33,43}

Conversion rate

No subject in this study required conversion to open appendectomy while 6% conversion rate was noted in Utpal and 5.88% in Khiria, Ardhari et al.^{32,36} Singh et al reported conversion rate of 1.33% while performing laparoscopic appendectomy using two supra pubic port technique.³⁴

Complications

Higher post-operative complications were recorded among open appendectomy than laparoscopic appendectomy group in this study, similarly Utpal found less overall complication rate following laparoscopic appendectomy.³² Statistically non-significant higher intra-abdominal abscess formation after laparoscopic surgery found in Aziz, Athanasiou et al.⁴⁵ Katkhouda, Mason et al found similar complication rates, irrespective of the technique ($p=0.181$).⁴⁶

Mortality

No mortality was reported in study, while study done by Sartelli et al at global level also reported mortality of less than one percent (0.28%) following appendectomy.⁴¹

Cost of treatment

Cost of appendectomy according to Central Government Health Scheme, Pune rate list, empanels hospital having NABH accreditation is 9,324 rupees. The cost of appendectomy in this institute is less than 1500 rupees in addition to the minimal expenses for the medications.

CONCLUSION

The main difference in management has been the restriction of morbidity, by utilizing minimal access strategies like laparoscopic appendectomy and open appendectomy. Both these techniques have brought about early return to preoperative status, because of the insignificant post-operative morbidity and discomfort. Laparoscopic technique, in addition to the above mentioned advantages has picked up dominance in view of the cosmetic desirability of the small scar. Laparoscopic appendectomy has developed as the best quality level in the treatment of inflamed appendix in terms of better cosmetic outcome, shorter hospital stay and early return to work. In our study, we found

laparoscopic approach to have these added advantages over open appendectomy. Although it is easier to teach and learn the laparoscopic technique with the help of amplified visual display, specific training is mandatory. And thus, the laparoscopic procedure has a steep learning curve. Open appendectomy, on the other hand, requires minimal expertise which is learned during the training period, hence does not have a steep learning curve, does not require any extra/special instruments, and is performed under direct three-dimensional vision. Laparoscopic appendectomy is better in case of simple, straight forward cases. Taking difference in the costs of instruments and the need for special training into consideration, significant difference is noted in overall expenses involved in the two procedures. And in a country like India, financial aspect plays a major role and needs to be considered.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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