

## Original Research Article

# Laparoscopy superseding open appendectomy: a prospective view

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### ABSTRACT

**Background:** Appendicitis is the most common surgical disease with appendectomy being the traditional treatment of choice. Different operative procedures exist for appendectomy. The objectives of the study were to compare the efficiency of laparoscopic versus open appendectomy and to compare post-operative complications between laparoscopic and open appendectomy.

**Methods:** This is a longitudinal study done from January 2018 till January 2020 in a tertiary care hospital of central India. A total of 400 operative patients were randomly selected and analysed with acute appendicitis (AA) as diagnosis. Sample size was randomized into two groups. Data was analysed with of open Epi version 2.3 and p value <0.05 was considered significant.

**Results:** Most common symptom was pain in right iliac fossa (94.63%). 18.18% had perforation while 26.38% had inflamed appendix. Histopathological assessment showed that 8.3% and 2.87% had suppurative and gangrenous appendicitis respectively. 23.82% of the open cases reported with surgical site infection (SSI). No SSI were reported in the laparoscopic group. Post-op duration for open and laparoscopic appendectomy was  $4.91 \pm 0.86$  and  $2.98 \pm 0.76$  (p value=0.04150) and was found to be statistically significant.

**Conclusions:** Open appendectomy is considered safe and effective but associated with complications such as ileus, intestinal obstruction, and wound sepsis. Laparoscopic appendectomy with high accuracy and low complication rate has emerged as the modus operandi and has superseded the open approach for treatment of AA.

**Keywords:** Appendix, Acute appendicitis, Laparoscopy, Minimal access surgery

### INTRODUCTION

Appendicitis is the most common surgical disease with appendectomy being the traditional treatment of choice. The diagnosis of acute appendicitis (AA) was based on clinical signs and symptoms before the advent of widespread use of sonography and computed tomography (CT) scans. Several diagnostic scoring systems such as Alvarado score, appendicitis inflammatory response (AIR) (Andersson score), World society of emergency surgery (WSES) AA grading system have been described.<sup>1</sup>

Obstruction of the lumen of appendix triggers a series of events that leads to AA. Fecalith is the most common cause

of obstruction, others being lymphoid hyperplasia, oedema, stricture, gallstones, and adhesions.<sup>2</sup> Emergency appendectomy was the choice of treatment for AA initially and any sort of delay in operative intervention was believed to lead to complications like perforation, and periappendiceal abscess. However, studies have shown that delayed appendectomy though less superior, does not lead to increased morbidity.<sup>3</sup>

Different operative procedures exist for appendectomy such as open appendectomy, laparoscopic appendectomy, single incision laparoscopic surgery (SILS)/single port laparoscopy (SPL) and via transvaginal route i.e. natural orifice transluminal endoscopic surgery (NOTES). The

idea of minimal access surgery has made laparoscopy a far more attractive option than the open approach. However, many studies have shown conflicting results. Some have demonstrated that laparoscopic route has better clinical outcomes while other have shown marginal or no clinical benefits and higher costs. Thus, there is no single consensus regarding the superiority of laparoscopic route over open.<sup>4</sup> However, there is a growing trend towards minimal access surgery (laparoscopy) due to the reduced magnitude of surgical injury and enhanced rate of patient's return to homeostasis and recovery.

Open appendectomy is considered safe and effective but associated with complications such as ileus, intestinal obstruction, and wound sepsis. Laparoscopic appendectomy with high accuracy and low complication rate has emerged as the *modus operandi* for both diagnosis and treatment of AA.<sup>5</sup>

Aim and objectives were to compare the efficiency of laparoscopic versus open appendectomy and to compare post-operative complications between laparoscopic and open appendectomy.

## METHODS

This is a longitudinal study done from January 2018 till January 2020 in a tertiary care hospital of Central India. A total of 400 patients were analysed with AA as diagnosis. Record was obtained from online patient data entry and from offline individual case files.

Demographic data such as age and sex along with clinical features and investigative findings were all collected and compiled. Data regarding patient follow-up for 2 weeks for post-op complications like wound sepsis, intra-abdominal abscess, ileus, and intestinal obstruction was collected.

All routine lab investigations were done along with sonography. Out of 400 patients, 200 were randomly sampled into open and laparoscopic appendectomy groups each.

### *Sampling technique*

The sampling technique used was randomization by random number table.

### *Subject criteria*

#### *Inclusion criteria*

All patients with acute appendicitis over the study period with fitness taken from anaesthetists and physicians.

#### *Exclusion criteria*

Patients declared unfit for surgery by either anaesthetists or physicians.

### *Intra-operative parameters*

Total operative time and laparoscopic to open conversion.

### *Post-operative parameters*

Post-operative pain, complications and duration of hospital stay.

All samples were sent for histopathological reporting. Final diagnosis was made with the help of intra-operative findings and histopathological reports.

Data was analysed with of open Epi version 2.3. Continuous variables are presented as mean  $\pm$ SD (standard deviation), and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups was performed using student's t-test. Nominal categorical data between the groups were compared using chi-squared test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

## RESULTS

A total of 400 patients were operated for appendectomy out of which 200 were via open approach and 200 were via laparoscopy. In the open appendectomy group, 113 were males and 87 were females, whereas in laparoscopic appendectomy, males and females were 125 and 75 respectively.

Most common symptom for appendicitis was found to be pain in abdomen in right iliac fossa (94.63%), followed by nausea and vomiting (55.5%). Fever was present in 17.17% patients. Most common sign was tenderness in right iliac fossa (58.37%) followed by rebound tenderness (21.6%). Amongst the laboratory parameters, leucocytosis was found in 23% followed by shift to left (16.74%).

From an intra-operative point of view, 18.18% patients had a perforated appendix, 26.38% had mild to moderately inflamed appendix, 8.1% had retro-caecal appendix and only 2.3% had mucocele appendix (Figure 1).

Mean total operative time was 47.2 SD 11.0 for open appendectomy and 68.2 SD 21.3 for laparoscopic appendectomy. A total of 18 laparoscopic appendectomies were converted to open approach due to intra-operative difficulties and a conversion rate of 7.69% was observed in this study. Pus collection was the leading factor was conversion from laparoscopic to open appendectomy accounting for 10 cases while lump formation resulted in conversion of 8 cases.

Histopathological assessment of all the appendix specimens showed that 27.75% had acute appendicitis, 17.7% had chronic appendicitis, 21.05% had acute on chronic appendicitis, 8.3% had suppurative appendicitis and 2.87% had gangrenous appendicitis. Post-operative

score was found to be 2.4 SD 0.4 for open appendectomy and 1.3 SD 0.3 for laparoscopic appendectomy. 23.82% of the OA cases reported with surgical site infection (SSI) in the form of wound gape in the follow-up period which was then treated with either re-suturing or healing by secondary intention with regular cleaning and dressing.

Amongst patients who underwent open appendectomy, post-operative ileus was encountered in 7.4% and faecal fistula was reported in only 0.2%. No post-operative complication was reported in the laparoscopic group (Figure 2).

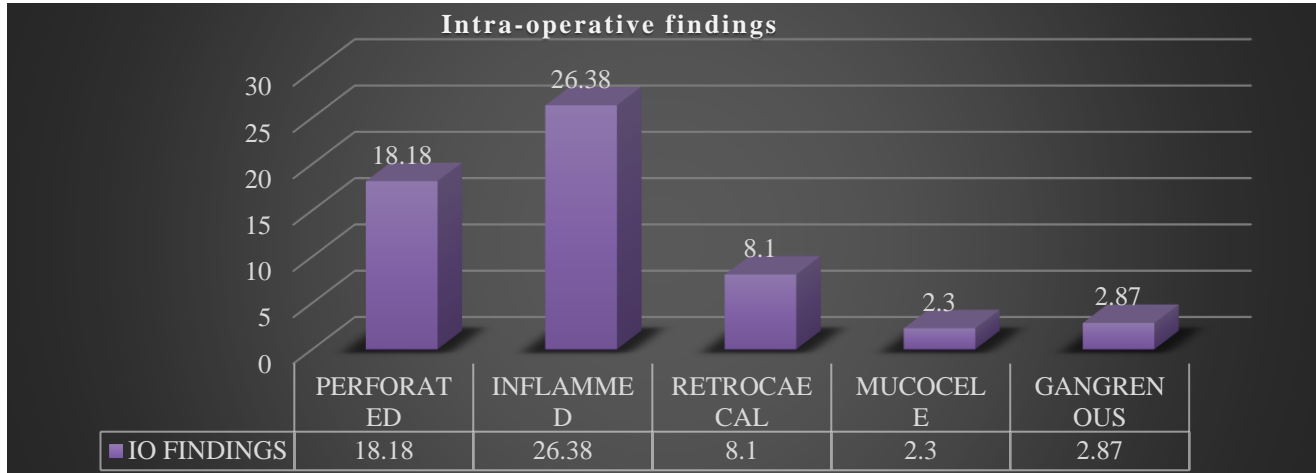


Figure 1: Intra-operative parameters.

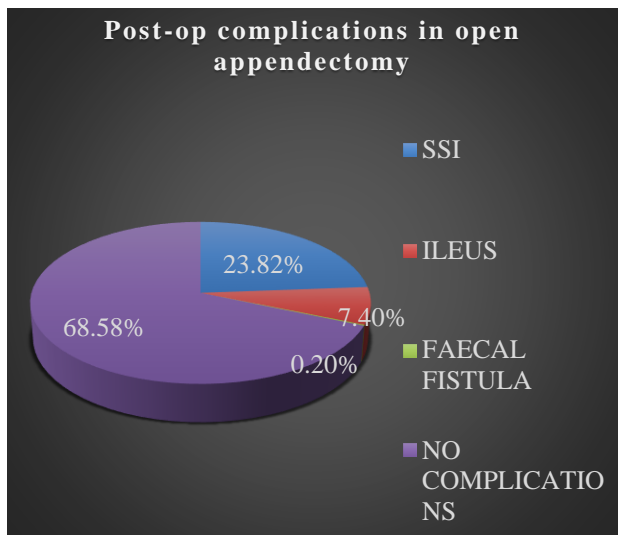


Figure 2: Post-operative complications.

Post-operative hospital stay for open and laparoscopic appendectomy was 4.91 SD 0.86 and 2.98 SD 0.76 (p value=0.04150) and was found to be statistically significant (Table 1).

Table 1: Comparison of post-operative hospital stay between laparoscopic and open appendectomy.

Post-operative hospital stay	Laparoscopic	Open	P value
	2.98 SD 0.76	4.91 SD 0.86	0.04150*

\*P value statistically significant.

## DISCUSSION

Various studies have been done over the years comparing the different approaches for appendectomy. Ekka et al studied the clinical presentation of 125 patients for a period of 2 years.<sup>6</sup> Alvarado scoring in the evaluation of acute appendicitis was studied by Özsoy et al amongst 156 patients and by Mahesh et al amongst 50 patients.<sup>7,8</sup> The comparison of their findings with our present study is shown in Table 2.

Retrospective data from 593 patients was collected by Biondi et al in 2016 and was compared for operative time, length of hospital stay, postoperative pain, complication rate, return to normal activity and cost. It was found that in LA, hospital stay was shorter (2.7±2.5 days) with faster return to normal activity (11.5±3.1 days) although total operative time for LA was more (31.36±11.13 min in OA and 54.9±14.2 in LA). Incidence for intra-abdominal abscess was found to be more in LA but it could be reduced with training and experience. Both procedures are still in practice with surgeon’s choice being the decisive factor.<sup>9</sup> No intra-abdominal abscess was reported in our study. However, other post-operative complications were present after open appendectomy like surgical site infections (SSI), ileus, and fecal fistula whereas none were reported after laparoscopic approach.

Some studies concluded that although post-op pain was more in OA, nausea was more pronounced in the laparoscopic group. No significant difference was found in the rest of the post-op complications. Even post-op stay duration was found to be statistically insignificant. Thus, the results of LA were comparable to OA, if not better.<sup>10</sup> In our study, laparoscopic approach was reserved only for

elective cases while all the emergency appendicitis cases were treated with open appendectomy. Cases posted electively who had significant guarding and rigidity and had been given a trial of antibiotics were also treated by open appendectomy. Operating time not only depends upon surgeon experience but also upon the complications that might occur during the procedure. Thus, it is difficult to have a uniform comparison between operative times of two different techniques as it is impossible for every intra-operative encounter to be similar. In the current study as well, patient satisfaction was found to be better with the laparoscopic approach especially when it came to female

rural population. Despite giving subcuticular skin stitches in some of the uncomplicated open appendectomy cases, patient's feedback was less positive in comparison to laparoscopic post-op scars. Laparoscopic approach was safer and more feasible according to certain studies with lower 30-day readmission rate, less post-op pain and less hospital stay. Some studies concluded that it was safer than OA. However, according to other studies there was no significant advantage of LA over OA except quality of life at 2 weeks. LA also took longer to perform. Thus, the decision between whether to perform OA or LA depended upon the surgeon or patient or both.<sup>11-14</sup>

**Table 2: Comparison of pre-operative clinical features of acute appendicitis.**

Variables	Present study	Ekka et al	Özsoy et al	Mahesh et al
<b>Total (N)</b>	634	125	156	50
<b>RIF pain (%)</b>	94.63	100	100	100
<b>RIF tenderness (%)</b>	58.37	89.6	80.12	100
<b>Nausea/ vomiting (%)</b>	55.5	84	43.58	84
<b>Rebound tenderness (%)</b>	21.6	72.8	74.35	74
<b>Fever (%)</b>	17.17	68	9.61	62
<b>Leucocytosis (%)</b>	23	66.4	50.64	62
<b>Shift to left (%)</b>	16.74	79.2	44.87	48

## CONCLUSION

On the basis of the current study, it can be concluded that laparoscopic appendectomy is a safe and efficient technique for appendicitis and visualization of abdomen intra-operatively for different pathologies, better cosmesis, patient satisfaction and less post-operative complications are its main advantages. Laparoscopic setup and its maintenance leading to higher costs is its biggest cons which has to be borne either by the institute or the patient. Both the procedures are still widely practised. Laparoscopic approach should be considered as the initial management especially in suspicious cases. Thus, the ultimate operative choice is entrusted to patient decision and the clinical knowledge and skill of the operating surgeon.

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