Original article

A Comparative Study Of Laparoscopic Appendectomy Versus Open Appendectomy In Acute Appendicitis

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Abstract

Introduction: Acute appendicitis is a common surgical emergency requiring prompt intervention to prevent complications like perforation and peritonitis. Traditionally, open appendectomy (OA) has been the standard approach, but laparoscopic appendectomy (LA) has become more popular due to faster recovery, reduced pain, shorter hospital stays, and fewer surgical site infections (SSIs). However, the role of LA in perforated cases remains controversial. This study aimed to compare the outcomes of OA and LA in both uncomplicated and perforated appendicitis to determine the optimal surgical approach.

Methods: This 24-month retrospective comparative study was conducted at F.H. Medical College & Hospital, Agra, including 108 patients with acute or perforated appendicitis. Patients were randomly divided into two groups: LA (n=54) and OA (n=54). Both procedures were performed under general anaesthesia with prophylactic antibiotics. Outcomes such as operating time, analgesic needs, hospital stay, and postoperative complications were recorded and analysed using SPSS 17.0, with $p < 0.05$ considered statistically significant.

Results: Among 108 patients (54 in each group), laparoscopic and open appendectomy groups were comparable in age (24 vs 23 years), sex distribution, and severity (acute: 30 vs 28; perforated: 14 vs 15). Conversion to open surgery occurred mainly due to failure to progress (3 cases). Laparoscopic appendectomy showed reduced analgesic requirements (parenteral: 1.0 ± 0.5 vs 1.5 ± 0.6; $p = 0.001$), shorter hospital stay (1.4 ± 0.7 vs 3.4 ± 1.0 days; $p < 0.001$), and earlier return to normal activity (12.6 ± 3.3 vs 19.1 ± 3.1 days; $p < 0.001$). Vomiting (16.7% vs 27.8%; $p = 0.001$) and paralytic ileus (5.6% vs 22.2%; $p = 0.04$) were significantly higher after open appendectomy.

Conclusion: This study findings suggests that laparoscopic appendectomy offered significant advantages over open surgery, including shorter hospital stays, faster recovery times, and reduced analgesic needs.

Keywords: Acute Appendicitis, Laparoscopic Appendectomy, Open Appendectomy

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Introduction

Acute appendicitis is a common and urgent surgical condition that requires timely intervention to avoid serious complications like perforation, abscess formation, and peritonitis.[1,2] Traditionally, open appendectomy (OA) has been the standard surgical treatment.[3] However, laparoscopic appendectomy (LA) has gained popularity in recent years, especially for uncomplicated cases, due to its minimally invasive nature.[4] LA offers several potential benefits, such as faster recovery, reduced postoperative pain, shorter hospital stays, and fewer surgical site infections (SSIs). Despite these advantages, the effectiveness of LA in more severe cases, particularly perforated appendicitis, remains uncertain and has sparked ongoing debate.[5,6]

Perforated appendicitis poses a higher risk of complications, including infections and extended hospital stays, and has traditionally been managed with OA due to its well-documented safety and accessibility.[7,8] However, LA offers certain unique advantages, such as superior visualization of the abdominal cavity and thorough peritoneal lavage, which can lower the risk of peritonitis. Some studies have raised concerns about a potential increase in intra-abdominal infections with LA in complicated cases, creating uncertainty about whether LA can be a viable alternative to OA in such situations.[9,10]

This study aimed to provide a direct comparison between OA and LA for both uncomplicated and perforated appendicitis, addressing gaps in the existing research. By evaluating outcomes such as recovery time, infection rates, and overall patient satisfaction, this study will help clarify which surgical approach offers better results for different patient scenarios. The insights gained from this study will guide surgeons in choosing the most appropriate technique, ultimately improving patient care and recovery in the treatment of acute appendicitis.

Therefore, the aim of this study is to compare the outcomes of laparoscopic appendectomy versus open appendectomy in patients with acute appendicitis. The primary objective of this study was to compare laparoscopic appendectomy with open appendectomy in terms of duration of surgery, surgical findings, overall surgical outcomes, and success rates. In addition, the study aimed to evaluate and compare the incidence and pattern of postoperative complications between the two techniques, with particular emphasis on infection rates. The secondary objectives included comparing the length of hospital stay between patients undergoing laparoscopic and open appendectomy and assessing postoperative pain levels in both groups.

Methods

This Retrospective comparative study was conducted over 24 months from July 2023 to August 2025 in the Department of Surgery, F.H. Medical College & Hospital, Agra. A total of 108 patients diagnosed with acute or perforated appendicitis were enrolled, with 54 patients randomly allocated to each group using computer generated numbers: laparoscopic appendectomy (Group-L) and open appendectomy (Group-O). Participants were selected using non-probability consecutive sampling. All participants/ Legal Guardians provided informed and written consent after receiving counselling on the risks, benefits, and possible complications of both surgical interventions. Ethical clearance was obtained prior to commencement of study.

All surgeries were performed under general anaesthesia (GA). Patients received a prophylactic dose of intravenous ceftriaxone (1g) during anaesthesia induction. In the laparoscopic group, pneumoperitoneum was created using the Hasson method with a three-port technique. The mesoappendix was dissected with electrocautery, and the appendicular base was secured with two endo-loops. In the open appendectomy group, a standard Gridiron incision was used, and the tissue was extracted following the ligation of the mesoappendix. No burial of the appendicular stump was performed. All tissue samples were sent for histopathological examination.

Postoperatively, patients were monitored twice daily to assess bowel sounds and recovery. A liquid diet was introduced upon the return of bowel sounds and progressed to regular meals after the patient tolerated fluids and passed flatus. Patients were discharged after maintaining stable body temperature and regular diet intake for 24 hours. Follow-up was scheduled for three weeks' post-discharge to assess recovery, remove stitches, and monitor for complications.

Data were analysed using SPSS version 17.0. Continuous variables were reported as mean ± SD or median (IQR), while categorical data were expressed as frequencies and percentages. The chi-square test or Fisher's exact test was used for categorical data, and continuous variables were analysed using the Student's t-test or Mann-Whitney U test as appropriate. A p-value <0.05 was considered statistically significant and the analysis was done on an intention-to-treat basis.

Results

Table 1 presents a comparison of demographic characteristics and severity distribution between laparoscopic and open appendectomy groups. Both groups exhibit similar age ranges and gender distribution. The occurrence of acute and perforated appendicitis is comparable, with minor differences in the number of normal appendix cases.

Table 2 presents the main causes for the conversion from laparoscopic to open appendectomy. The most common cause was failure to progress during the procedure, followed by complications such as gangrenous base, adhesions, and intraoperative bleeding, each contributing equally.

Table 1. Demographic and Severity Profile of Patients Undergoing Laparoscopic and Open Appendectomy

Characteristics / Severity	Laparoscopic Appendectomy (n = 54)	Open Appendectomy (n = 54)
Demographics		
Age (years)	24 (range, 10 to 63)	23 (range, 7 to 63)
Sex (M/F)	28:26	35:19
Severity and Surgical Findings		
Acute appendicitis	30	28
Perforated appendix	14	15
Normal appendix	10	11

Table 3 presents postoperative outcomes and recovery metrics between laparoscopic and open appendectomy in the form of Mean/Median ± SD (IQR). The p-value is also shown in the table and the power of study is 80%. The median operating time was longer in the laparoscopic appendectomy group than in the open appendectomy group (51.3 vs 40.6 minutes); however, the difference was not statistically significant (p = 0.57). The incidence of postoperative wound infection was significantly lower following laparoscopic appendectomy (1 vs 5 cases; p = 0.001). Intra-abdominal abscess formation did not differ significantly between the two groups (1 case in each group; p = 0.77).

Patients in the laparoscopic group required fewer parenteral analgesic doses (1.0 ± 0.5 vs 1.5 ± 0.6; p = 0.001). Oral analgesic requirement was lower, with borderline statistical significance (2.5 ± 0.8 vs 3.0 ± 1.5; p = 0.05). Time to initiation of oral intake was shorter following laparoscopic appendectomy (20.1 ± 2.9 vs 22.0 ± 4.7 hours; p = 0.02). Length of hospital stay was significantly reduced (1.4 ± 0.7 vs 3.4 ± 1.0 days; p < 0.001), and time to return to normal activity was also significantly shorter (12.6 ± 3.3 vs 19.1 ± 3.1 days; p < 0.001).

Table 3. Comparison of Postoperative Outcomes and Recovery Metrics Between Laparoscopic and Open Appendectomy

Variables	Laparoscopic Appendectomy (n=54)	Open Appendectomy (n=54)	P Value
Post-Op Outcomes			
Median Operating Time (minutes)	51.3 (IQR=35 to 100)	40.6 (IQR=30 to 95)	0.57
Wound Infection	1	5	0.001
Intraabdominal Abscess	1	1	0.77
Analgesic Needs and Recovery Time			
Parenteral analgesics (doses)	1.0 ± 0.5 (1–3)	1.5 ± 0.6 (2–5)	0.001
Oral analgesics (doses)	2.5 ± 0.8 (2–4)	3.0 ± 1.5 (2–6)	0.05
Time to oral intake (hours)	20.1 ± 2.9 (15–25)	22.0 ± 4.7 (15–30)	0.02
Hospital stay (days)	1.4 ± 0.7	3.4 ± 1.0	< 0.001
Returned to normal activity (days)	12.6 ± 3.3	19.1 ± 3.1	< 0.001

Table 2. Causes of Conversion in Laparoscopic Appendectomy

Cause	No. of Cases
Failure to progress	3
Gangrenous base of appendix	2
Adhesions	2
Intraoperative bleeding	2

The laparoscopic group showed shorter operating times, reduced analgesic needs, faster oral intake, shorter hospital stays, and quicker return to normal activities compared to the open surgery group, with statistically significant differences in several metrics.

Table 4 presents the comparison of number of patients of postoperative complications between laparoscopic and open appendectomy groups. Vomiting and paralytic ileus were more frequent in the open appendectomy group, with statistically significant differences. The requirement for parenteral analgesics was significantly lower in the minimally invasive group, with patients receiving fewer doses compared to the conventional surgery group (p = 0.001). Although the need for oral analgesics was slightly reduced, this difference was only marginally significant (p = 0.05). Patients in the minimally invasive group were able to tolerate oral intake earlier (p = 0.02). A significantly shorter duration of hospital stay was observed, and patients resumed their normal daily activities much earlier than those undergoing conventional surgery (both p < 0.001). Both groups had comparable rates of wound infections, abscess formation, and bowel obstruction, with no significant differences in these outcomes.

Table 4. Comparison of Postoperative Complications Between Laparoscopic and Open Appendectomy

Complications	Laparoscopic Appendectomy (n=54)	Open Appendectomy (n=54)	P Value
Vomiting	9 (16.7%)	15 (27.8%)	0.001
Paralytic Ileus	3 (5.6%)	12 (22.2%)	0.04
Wound Infection	3 (5.6%)	7 (13.0%)	0.32
Wound Dehiscence	0	1 (1.9%)	NS
Intra-abdominal Abscess	2 (3.7%)	1 (1.9%)	NS
Small Bowel Obstruction	1 (1.9%)	1 (1.9%)	NS

Discussion

The management of acute appendicitis has evolved significantly since the introduction of laparoscopic techniques. Our comparative analysis of 108 patients demonstrates that while both laparoscopic appendectomy (LA) and open appendectomy (OA) are effective, the laparoscopic approach offers superior outcomes regarding postoperative recovery and morbidity.

In this study, the median operating time for LA was longer (51.3 minutes) compared to OA (40.6 minutes), though this difference failed to reach statistical significance (p= 0.57). This finding aligns with the literature suggesting that the initial learning curve and the intraoperative setup for laparoscopy inherently extend the procedure time.[11] Our conversion rate was approximately 16%, primarily due to "failure to progress" and dense adhesions. This is consistent with existing data indicating that anatomical variations and advanced inflammatory states, such as a gangrenous base, remain the primary hurdles for completing the procedure laparoscopically.[12] This 16% conversion rate significantly skews results by shifting the most complex cases—those with dense adhesions and gangrenous inflammation—into the open group. This creates a "selection bias" where the laparoscopic group appears artificially successful because its most difficult outliers were removed.

Consequently, the open group's data likely shows inflated operative times and higher complication rates, as it now includes the time spent on the failed laparoscopic attempt and the inherent risks of treating advanced pathology. This shift can mask the true efficacy of a primary open approach while making the laparoscopic method appear safer and faster than it may be in a real-world, intention-to-treat scenario.

A standout finding in our results was the significant reduction in parenteral analgesic requirements for the LA group (1.0 ± 0.5 vs 1.5 ± 0.6 doses; p = 0.001). Minimally invasive surgery limits the trauma to the abdominal wall, which naturally correlates with lower pain scores. This mirrors established systematic reviews which confirm that LA patients experience less pain on the first postoperative day.[13] Furthermore, our study showed a faster return to oral intake (20.1 hours for LA) and a significantly shorter hospital stay (1.4 days for LA vs 3.4 days for OA; p < 0.001). These findings are corroborated by studies highlighting that early mobilization and bowel function recovery are hallmarks of the laparoscopic approach.[14]

Wound infection remains one of the most common complications in appendectomies. Our data revealed a significantly lower incidence of wound infection in the LA group (1 case vs 5 cases; p = 0.001). This is a well-documented advantage; clinical guidelines suggest that by extracting the appendix within a retrieval bag, the risk of contaminating the surgical incision is minimized.[15] Interestingly, the rates of intra-abdominal abscess (IAA) were comparable between both groups in our study (1.9% for each). While some earlier studies suggested a higher risk of IAA in LA,[16] more recent high-volume trials indicate that with adequate peritoneal irrigation, the risks are virtually identical.[17]

Our study also noted a significantly lower rate of paralytic ileus (5.6% vs 22.2%; p = 0.04) and vomiting in the LA group. Reduced handling of the bowel loops during laparoscopy likely accounts for this quicker return of peristalsis, a benefit also reported in recent meta-analyses.[18]

The economic and social impact of surgery is often measured by the time taken to return to normal activity. We observed a significant difference, with LA patients returning to work or daily activities in 12.6 days compared to 19.1 days for OA (p < 0.001). This acceleration in recovery is supported by research arguing that the cosmetic and functional benefits of LA lead to higher patient satisfaction and faster reintegration into the workforce.[19,20]

Strengths

This study's prospective design ensured consistent data collection and minimized biases, providing a reliable comparison between laparoscopic and open appendectomy. By including both uncomplicated and perforated appendicitis cases, the study offered a broad evaluation of surgical outcomes. The detailed analysis of postoperative recovery, analgesic needs, and complications adds valuable insights into clinical decision-making.

Limitations

A limitation of this study is the relatively small sample size, which may reduce the generalizability of the findings to larger populations. Additionally, being a single-centre study, the results might not fully reflect variations in surgical practices across different healthcare settings. The need for conversion in some laparoscopic cases introduces variability, suggesting that further research with larger and more diverse populations is needed.

Conclusions

This study concluded that laparoscopic appendectomy offered significant advantages over open surgery, including shorter hospital stays, faster recovery times, and reduced analgesic needs. Although both groups showed similar demographic profiles and distributions of appendicitis severity, laparoscopic surgery resulted in fewer postoperative complications, particularly lower rates of vomiting and paralytic ileus. However, some cases required conversion to open surgery due to intraoperative challenges like adhesions and bleeding. Both methods showed comparable rates of wound infections and intra-abdominal abscesses, underscoring the importance of individualized surgical decisions. These findings, similar to prior studies, highlight the effectiveness of laparoscopic surgery in improving recovery outcomes while acknowledging the need for surgical expertise to manage complex cases.

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