RESEARCH PAPER

Laparoscopic Versus Open Appendicectomy in Complicated Appendicitis: A Retrospective Comparative Analysis of Surgical Outcomes

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Abstract

Background: Surgeons remain divided on the optimal surgical approach for complicated appendicitis. This study compared outcomes of laparoscopic appendicectomy (LA) with open appendicectomy (OA) in this patient population.

Methods: A retrospective review of 150 patients with intraoperatively confirmed complicated appendicitis (LA: n=75, OA: n=75) was conducted. Demographics, operative time, intraoperative findings, postoperative complications, hospital stay, time to resumption of normal activity, and pain scores were analysed using SPSS v22.0. Significance was set at $p<0.05$.

Results: Demographic characteristics were comparable between groups. Mean operative time was significantly longer for LA than OA (80.35 vs 55.80 minutes; $p<0.001$). Postoperative complications were significantly less frequent after LA than OA (20% vs 60%; $p=0.037$), with zero organ/space surgical site infections in the LA group compared with 14.7% in the OA group. LA patients also had shorter hospital stay (2.65 vs 4.25 days; $p=0.009$), faster return to normal activity (4.95 vs 8.10 days; $p=0.003$), and lower pain scores at 6 hours postoperatively (2.65 vs 4.50; $p<0.001$).

Conclusion: Despite a longer operative duration, laparoscopic appendicectomy is a safer and more effective surgical option than open appendicectomy for complicated appendicitis, offering fewer complications, less pain, shorter hospital stay, and faster recovery.

Keywords: Appendicitis; Complicated appendicitis; Laparoscopic appendicectomy; Open appendicectomy; Surgical outcomes; Postoperative complications

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Introduction

Few surgical emergencies present as often as acute appendicitis, which affects roughly 7–8% of people over a lifetime [1]. Once the disease becomes complicated — gangrene, perforation, abscess, or mass formation — the surgical challenge escalates sharply, bringing with it higher postoperative morbidity and a longer road to recovery than straightforward, uncomplicated cases [2]. Open appendicectomy (OA) long held the position of default technique, though laparoscopic appendicectomy (LA) has steadily won favour for its minimally invasive profile, with advocates pointing to less postoperative pain, shorter admissions, and quicker return to daily activity [3]. Its role in complicated disease, however, remains contested — critics cite longer operative times, the technical demands of operating through heavily inflamed tissue, and a theoretical risk of residual intra-abdominal abscess needing further treatment [4].

This study was designed to build institution-level comparative evidence for the surgical management of complicated appendicitis, setting OA and LA outcomes directly against one another [5]. Uncomplicated appendicitis has been compared extensively in the literature, but the picture for complicated disease is far less settled — published meta-analyses and retrospective series disagree on both complication rate and cost-effectiveness [6]. Our analysis aims to help resolve technique selection and resource planning for complicated appendicitis at the local, institutional level. A further complicating factor in interpreting the existing literature is inconsistent case definition: some series classify appendicitis as "complicated" based on preoperative imaging alone, while others — as in the present study — require intraoperative confirmation. This distinction matters, since preoperative imaging can both under- and over-call disease severity relative to what is actually found at surgery, and comparative outcome data derived from imaging-based classification may not translate cleanly to a

population defined by confirmed intraoperative findings.

The objective of our study is to compare operative duration between laparoscopic and open appendicectomy for complicated appendicitis, To determine differences in rates of surgical site infection (SSI) and intra-abdominal abscess (IAA) between the two approaches, To evaluate hospital stay and time to resumption of normal activity following laparoscopic versus open surgery, To quantify postoperative pain scores between the two surgical approaches, To characterise and compare the spectrum of intraoperative findings (gangrenous, perforative, abscessed, or mass-forming disease) between the laparoscopic and open surgical groups, to assess whether disease severity at operation was comparable between arms. The clinical equipoise surrounding surgical technique selection in complicated appendicitis stems from a genuine tension in the literature: while the minimally invasive advantages of laparoscopy are well established for uncomplicated disease, the inflamed, friable, and often abscess-containing operative field of complicated appendicitis introduces technical demands that some surgeons feel are better managed through direct open access.

This study was conceived specifically to test whether the well-documented benefits of laparoscopy persist, diminish, or reverse once disease complexity is held constant across both study arms — a question best answered using intraoperatively-confirmed (rather than merely preoperatively-suspected) complicated appendicitis as the inclusion criterion, as applied here. By restricting enrolment to cases where complication was verified at the time of surgery, we sought to isolate the effect of surgical approach itself from the confounding effect of misclassified disease severity that can arise when preoperative imaging alone is used to define a "complicated" cohort.

Materials and Methods

Study design: retrospective comparative study. The study Setting and population includes 150 patients with intraoperatively confirmed complicated appendicitis underwent either laparoscopic (LA) or open (OA) appendicectomy at Saveetha Medical College and Hospital, between January 2024 and December 2025 with Inclusion criteria of patients aged ≥18 years, with a preoperative diagnosis of acute appendicitis, confirmed as complicated appendicitis on the operative report, undergoing either LA or OA and Exclusion criteria of uncomplicated appendicitis; conversion from LA to OA; incomplete medical records.

The Data collection is done by operative theatre records, anaesthesia charts, and medical records using a standard proforma, capturing preoperative demographics and comorbidities, intraoperative operative time and findings, and postoperative complications, hospital stay, time to normal function, and visual-analogue pain score at 6 hours. Ethical consideration was approved by the Institutional Ethics Committee, with patient confidentiality maintained throughout and Statistical analysis were coded and analysed in SPSS for Windows v22.0 (IBM Corp.). Continuous variables (mean ± SD) were compared using Student's t-test; categorical variables (frequency/percentage) were compared using the Chi-square test. Significance was set at $p<0.05$.

Results

Demographic profiles were comparable between groups: mean age 35.10 ± 12.48 years (LA) versus 30.80 ± 12.15 years (OA; $p>0.05$); male predominance was noted in both groups (50% LA, 55% OA). Intraoperative findings were broadly similar between groups, though gangrenous appendix was somewhat more frequent in the LA group (40.0% vs 34.7%; $p=0.038$) (Table 1). Postoperative complications were significantly less frequent after LA (20.0%) than OA (60.0%; $p=0.037$) (Table 2). Incisional surgical site infection occurred in 20.0% of LA versus 34.7% of OA patients. Critically, organ/space surgical site infection (intra-abdominal abscess) occurred in 0% of LA patients versus 14.7% of OA patients. Readmission occurred in 0% of LA versus 2.7% of OA patients.

Mean operative time was significantly longer with LA (80.35 ± 13.01 minutes) than OA (55.80 ± 9.88 minutes; $p<0.001$) (Table 3). Despite the longer operative time, LA patients had a significantly shorter mean hospital stay (2.65 ± 1.81 vs 4.25 ± 1.83 days; $p=0.009$), faster mean return to normal activity (4.95 ± 2.23 vs 8.10 ± 3.74 days; $p=0.003$), and significantly lower pain scores at 6 hours postoperatively (2.65 ± 1.42 vs 4.50 ± 1.36; $p<0.001$).

Table 1. Intraoperative Findings

Intraoperative Finding	Group A: LA (n=75)	Group B: OA (n=75)	Total (n=150)	p-value
Gangrenous appendix	30 (40.0%)	26 (34.7%)	56 (37.3%)	0.038
Appendicular abscess	15 (20.0%)	19 (25.3%)	34 (22.7%)	—
Appendicular	11	10	21	—

mass	(14.7%)	(13.3%)	(14.0%)	
Perforative appendicitis	19 (25.3%)	20 (26.7%)	39 (26.0%)	—

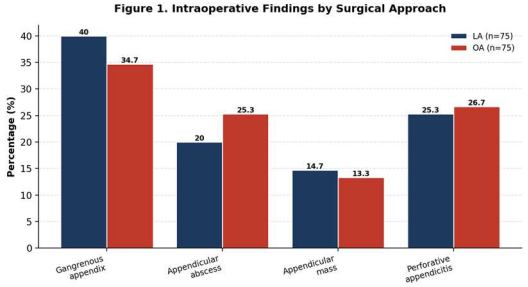

Figure 1: Distribution of intraoperative findings among patients undergoing laparoscopic (LA) versus open (OA) appendicectomy.

Table 2. Postoperative Complications

Postoperative Complication	Group A: LA (n=75)	Group B: OA (n=75)	Total (n=150)	p-value
No complications	60 (80.0%)	30 (40.0%)	90 (60.0%)	0.037
Incisional surgical site infection	15 (20.0%)	26 (34.7%)	41 (27.3%)	—
Organ/space surgical site infection	0 (0.0%)	11 (14.7%)	11 (7.3%)	—
Readmission	0 (0.0%)	2 (2.7%)	2 (1.3%)	—

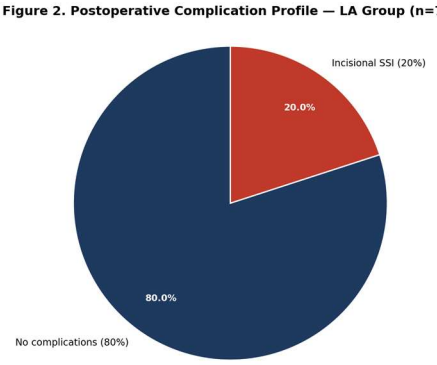

Figure 2: Postoperative complication profile in the laparoscopic appendicectomy group, showing zero organ/space infections.

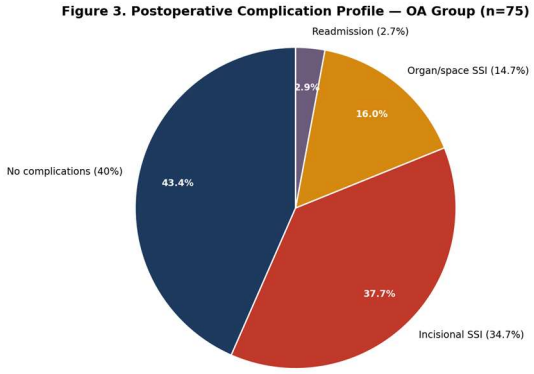

Figure 3: Postoperative complication profile in the open appendicectomy group, showing a substantially higher rate of both incisional and organ/space infection.

Table 3. Operative and Postoperative Parameters (Mean ± SD)

Variable	Group A: LA	Group B: OA	t-value	p-value
Operative time (minutes)	80.35 ± 13.01	55.80 ± 9.88	66.721	<0.001
Hospital stay (days)	2.65 ± 1.81	4.25 ± 1.83	22.775	0.009
Time to return to normal (days)	4.95 ± 2.23	8.10 ± 3.74	3.233	0.003
Pain score (6 hours post-op)	2.65 ± 1.42	4.50 ± 1.36	4.205	<0.001

** Significant (p<0.05); ** Highly significant (p<0.001)*

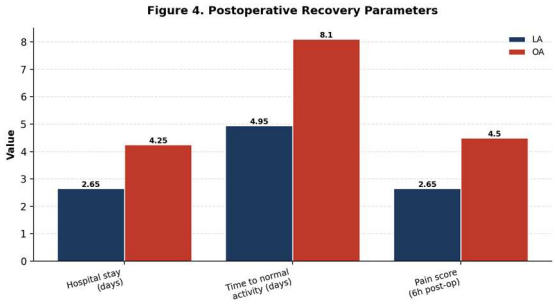

Figure 4: Comparative postoperative recovery metrics between laparoscopic and open appendicectomy groups.

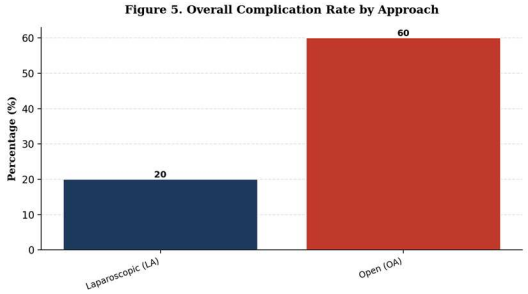

Figure 5: Overall postoperative complication rate — laparoscopic appendicectomy was associated with a three-fold lower complication rate than open appendicectomy.

Discussion

Our findings confirm the previously described relationship between operative time and surgical morbidity: although LA required significantly longer operative time than OA (80.35 vs 55.80 minutes), it was associated with markedly better postoperative recovery and lower morbidity. The longer operative duration observed for LA in our series exceeds that reported in some earlier studies, likely reflecting the technical complexity of operating within an inflamed field — dissecting adhesions, performing peritoneal lavage, and a steeper learning curve for complicated cases [7]. Athanasiou et al., in a meta-analysis of complicated appendicitis, similarly reported increased operative time for laparoscopic surgery, particularly outside high-volume centres [5]; the clinical significance of this additional 20–30 minutes should be weighed against the substantial recovery advantages observed.

The overall complication rate was significantly lower for LA than OA (20% vs 60%), driven predominantly by a reduction in surgical site infection — both incisional (20% vs 34.7%) and, most notably, organ/space infection (0% vs 14.7%). Organ/space infection (intra-abdominal abscess) is a clinically significant complication associated with prolonged antibiotic therapy, potential need for percutaneous drainage, and extended hospitalisation. Proposed mechanisms for this benefit include reduced tissue manipulation, minimised wound-edge exposure to contaminated intraperitoneal contents, and more effective peritoneal lavage under laparoscopic magnification. Masoomi et al. reported a similar trend of lower complication and wound infection rates for LA in a large database study of complicated appendicitis [6].

Postoperative recovery parameters consistently favoured LA: shorter hospital stay (2.65 vs 4.25 days) and faster return to normal activity (4.95 vs 8.10 days), together with significantly lower pain scores at 6 hours, likely facilitating earlier mobilisation — findings consistent with the broader literature on minimally invasive surgical technique and comparable to results reported by Singh et al. [9]. While earlier studies raised concern regarding a potentially higher incidence of intra-abdominal abscess with LA in complicated appendicitis [10], our LA group demonstrated a zero percent incidence of this complication, suggesting that meticulous surgical technique — including careful haemostasis, avoidance of stone/faecolith spillage, and thorough irrigation — can substantially mitigate this risk. This finding is consistent with more recent data and meta-analyses reporting no difference, or even a lower incidence, of intra-abdominal abscess with LA [5,11].

The magnitude of the incisional versus organ/space infection differential also merits comment: while incisional SSI rates were meaningfully lower with LA (20.0% vs 34.7%), the gap widened further for organ/space infection (0% vs 14.7%), a pattern that fits mechanistically with the laparoscopic approach's smaller wound footprint and reduced direct wound-field contamination — the incisional advantage is real, but the deep-space advantage appears to be the larger and more clinically consequential of the two. The economic dimension of this comparison, while not directly measured in our dataset, is worth noting: the shorter hospital stay and lower complication-driven resource utilisation (fewer readmissions, fewer deep infections requiring prolonged antibiotics or drainage) associated with LA may offset its longer operative time and any associated higher direct theatre cost, though a formal cost-effectiveness analysis incorporating local tariff data would be required to confirm this for our setting specifically.

The strengths of our study is balanced group sizes (75 patients per arm) with intraoperatively-confirmed complicated appendicitis in both groups, ensuring like-for-like disease severity comparison rather than contrasting complicated with uncomplicated disease across arms. A comprehensive, pre-specified outcome set spanning operative, early postoperative, and functional recovery domains (pain score, time to normal activity) rather than operative outcomes alone, giving a more complete picture of the patient-experienced burden of each approach. Consistent, standardised outcome definitions applied via a single data-collection proforma across both surgical arms, reducing the risk of differential outcome ascertainment bias between groups.

The limitations of our study includes retrospective design introduces potential selection bias, as choice of surgical technique reflected individual surgeon assessment and may have been influenced by disease

severity or patient factors not fully captured in this analysis. Single-centre study, which may limit generalisability of findings to other settings. Long-term complications such as incisional hernia and adhesion formation were not assessed in this analysis. Surgeon-level experience and case-volume were not captured as variables, and it is plausible that outcome differences between approaches were partly moderated by individual operator familiarity with laparoscopic technique in the inflamed, complicated setting. Cost data were not collected, precluding formal economic evaluation alongside the clinical outcome comparison presented here. In summary, although laparoscopic appendicectomy required a longer operative time than open surgery for complicated appendicitis in our population, it yielded more favourable overall outcomes — fewer postoperative complications (particularly deep/organ-space surgical site infection), less pain, shorter hospital stay, and earlier return to normal activity.

These findings support laparoscopic appendicectomy as the preferred approach for complicated appendicitis at institutions with experienced laparoscopic surgical expertise. The Clinical Implications for Practice includes Service planning: where laparoscopic expertise and equipment are available, our data support routing complicated appendicitis toward the laparoscopic approach by default, with open surgery reserved for cases where laparoscopic access is technically unsafe or expertise is unavailable, rather than the reverse default. Theatre time allocation: the near-25-minute average time differential should be factored into operative list planning for complicated appendicitis presenting as emergencies, to avoid list overruns that could compromise care for subsequent patients. Training implications: given that technical difficulty in an inflamed field was identified as a key driver of the operative-time differential, structured laparoscopic training specifically targeting complicated, high-inflammation cases (rather than routine uncomplicated appendicitis) may help further narrow this time gap over time without sacrificing the safety advantages observed.

Future research directions of our study includes, A prospective, ideally multicentre, study incorporating surgeon-level case-volume and years of laparoscopic experience as covariates would help disentangle the contribution of technique from that of individual operator skill to the outcome differences observed here. Formal, prospectively-collected cost data — encompassing theatre time, consumables, length of stay, and readmission-related expenditure — would allow a direct cost-effectiveness comparison between laparoscopic and open appendicectomy specifically in the complicated-disease subgroup, an analysis not possible with the present retrospective dataset. Extended follow-up beyond the immediate postoperative window, capturing incisional hernia rate, adhesive small bowel obstruction, and chronic pain at 12 and 24 months, would clarify whether the early-recovery advantages of the laparoscopic approach translate into durable long-term benefit. Sub-stratification of the complicated appendicitis cohort by specific intraoperative finding (gangrenous versus perforated versus abscessed versus mass-forming disease) in a larger sample could determine whether the laparoscopic advantage is uniform across all complicated subtypes or concentrated in particular presentations.

Conclusion

Laparoscopic appendicectomy requires a longer operative time than open appendicectomy for complicated appendicitis. Despite this, laparoscopic appendicectomy is associated with substantially lower rates of postoperative complications — particularly intra-abdominal abscess — less postoperative pain, shorter hospital stay, and faster return to normal activity. Laparoscopic appendicectomy should be considered the preferred surgical approach for patients with complicated appendicitis at institutions equipped with adequate laparoscopic surgical expertise.

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