

Laparoscopic Versus Open Appendectomy for Complicated Acute Appendicitis: Comparative Clinical Outcomes

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Abstract: Background. Complicated acute appendicitis remains a common indication for emergency surgery and is associated with a higher risk of infectious morbidity than uncomplicated disease. Objective. To compare early clinical outcomes of laparoscopic and open appendectomy in adults with complicated acute appendicitis. Materials and methods. A retrospective comparative study included 148 patients with gangrenous or perforated appendicitis, localized or diffuse peritonitis, or periappendiceal inflammatory changes requiring appendectomy. The numerical dataset used in this manuscript is modeled for article development and should be verified against primary clinical records before submission. Seventy-nine patients underwent laparoscopic appendectomy and 69 underwent open appendectomy. Operative duration, postoperative pain, return of bowel function, surgical-site infection, intra-abdominal abscess, length of stay, and reoperation were assessed. Results. Laparoscopic appendectomy was associated with longer operative time but lower early pain scores, earlier restoration of bowel function, fewer superficial surgical-site infections, and shorter hospitalization. The frequency of postoperative intra-abdominal abscess did not differ significantly between groups. Conclusion. In appropriately selected patients with complicated acute appendicitis, the laparoscopic approach provides favorable short-term recovery without an apparent increase in major intra-abdominal infectious complications.

Keywords: complicated acute appendicitis; laparoscopic appendectomy; open appendectomy; perforated appendicitis; surgical-site infection; postoperative recovery

Introduction

Acute appendicitis is one of the most frequent causes of emergency abdominal surgery. Although uncomplicated disease is generally associated with rapid recovery after appendectomy, complicated appendicitis including gangrene, perforation, periappendiceal abscess, and peritonitis continues to create substantial perioperative challenges. These patients have a greater bacterial burden, more extensive local inflammation, and a higher probability of postoperative infectious complications [1].

The choice between laparoscopic and open appendectomy has evolved considerably. Laparoscopy offers improved visualization of the abdominal cavity, smaller incisions, and potentially faster postoperative recovery [2]. Current World Society of Emergency Surgery recommendations favor laparoscopic appendectomy over the open approach for both uncomplicated and complicated acute appendicitis when appropriate equipment and surgical expertise are available. The evidence supporting laparoscopy includes lower postoperative pain, fewer wound infections, and shorter hospital stay, although concerns regarding intra-abdominal abscess after perforated appendicitis have historically remained [3].

In complicated disease, the clinical value of a minimally invasive approach depends not only on technical feasibility but also on the adequacy of source control. Dense inflammatory adhesions, appendiceal mass, diffuse contamination, friable tissues, and difficult identification of the appendiceal base may increase operative complexity and occasionally necessitate conversion. For this reason, comparative evaluation in routine emergency practice remains relevant [4].

The aim of this study was to compare early postoperative outcomes of laparoscopic and open

appendectomy in patients operated on for complicated acute appendicitis [5].

Materials and Methods

The study was designed as a retrospective comparative analysis of 148 adult patients treated surgically for complicated acute appendicitis. Complicated appendicitis was defined by intraoperative evidence of gangrenous appendicitis, perforation, localized or diffuse peritonitis, periappendiceal abscess, or marked inflammatory changes requiring operative source control. Patients younger than 18 years, patients managed non-operatively, and cases with incomplete postoperative documentation were excluded.

Patients were divided according to surgical approach. Group I consisted of 79 patients who underwent conventional three-port laparoscopic appendectomy. Group II included 69 patients treated by open appendectomy through a right lower quadrant or extended access according to intraoperative findings. The decision regarding approach was based on clinical status, local anatomy, availability of laparoscopic equipment, and surgeon experience.

All patients received perioperative antimicrobial therapy appropriate for complicated intra-abdominal infection. During laparoscopy, the abdominal cavity was systematically inspected and contaminated fluid was aspirated. The appendix was mobilized, the mesoappendix divided, and the appendiceal stump securely closed. In the open group, appendectomy and source control were performed according to standard surgical principles. Drains were not considered mandatory and were used selectively according to intraoperative findings.

The primary outcomes were postoperative surgical-site infection and length of hospital stay. Secondary outcomes included operative duration, pain intensity 24 hours after surgery using a 10-point visual analogue scale (VAS), time to first bowel sounds or passage of flatus, intra-abdominal abscess, reoperation, and overall postoperative morbidity. Continuous variables were compared using Student's t-test or Mann–Whitney U test as appropriate; categorical variables were assessed with the chi-square or Fisher exact test. Statistical significance was accepted at $p < 0.05$.

Results

The laparoscopic group included 79 patients and the open group 69 patients. Baseline age and sex distribution were comparable. Perforated appendicitis with localized or diffuse peritonitis represented the predominant complicated pattern in both groups [6]. Conversion from laparoscopy to open surgery occurred in 5 of 79 patients (6.3%), mainly because of dense inflammatory adhesions or difficulty achieving safe control of the appendiceal base; these cases were analyzed according to the initially selected approach [7].

Mean operative duration was longer in the laparoscopic group. Despite this difference, postoperative recovery favored laparoscopy. Pain intensity at 24 hours was lower, restoration of bowel function occurred earlier, and hospital stay was approximately two days shorter. Superficial surgical-site infection was significantly less frequent after laparoscopic surgery [8].

Table 1. Comparison of early postoperative outcomes between surgical approaches.

Outcome	Laparoscopic (n=79)	Open (n=69)	p value
Operative time, min	78.6±21.4	65.2±19.7	<0.001
VAS pain at 24 h	3.1±1.2	4.6±1.4	<0.001
Return of bowel function, h	27.8±10.5	38.4±13.1	<0.001
Superficial SSI, n (%)	5 (6.3)	12 (17.4)	0.035
Intra-abdominal abscess, n (%)	4 (5.1)	5 (7.2)	0.733
Reoperation, n (%)	2 (2.5)	3 (4.3)	0.663
Hospital stay, days	5.8±2.1	7.9±3.0	<0.001

Postoperative intra-abdominal abscess developed in 4 patients (5.1%) after laparoscopic appendectomy and 5 patients (7.2%) after open surgery; the difference was not statistically significant [9]. Reoperation was uncommon in both groups. The overall pattern therefore suggested that the reduction in wound morbidity and faster functional recovery after laparoscopy was not accompanied by a measurable increase in deep intra-abdominal infection in this modeled cohort [10].

Discussion

The principal finding of this comparative analysis is that laparoscopic appendectomy was associated with a more favorable early postoperative course in complicated acute appendicitis. The main benefits were lower pain intensity, earlier restoration of intestinal function, reduced superficial wound infection, and shorter hospitalization. These advantages were achieved despite a modest increase in operative duration [11].

The lower incidence of superficial surgical-site infection is particularly relevant in complicated appendicitis. Open access exposes the incision to contaminated tissues and infected peritoneal fluid, whereas laparoscopic extraction through a protected trocar site reduces direct wound contamination. This observation is consistent with the evidence summarized in the WSES Jerusalem guidelines, which identify a lower incidence of surgical-site infection as one of the major advantages of laparoscopic appendectomy and recommend laparoscopy as the preferred surgical approach when expertise and equipment are available [12].

Historically, a potential increase in postoperative intra-abdominal abscess represented one of the principal arguments against laparoscopy in perforated appendicitis. More contemporary analyses, however, have not consistently confirmed a clinically important disadvantage. In our modeled dataset, intra-abdominal abscess occurred at similar rates in both groups. This supports the view that adequate source control, careful aspiration of infected collections, appropriate antimicrobial treatment, and sound operative technique may be more important than the access route itself [13].

The faster return of bowel function and shorter hospital stay observed after laparoscopy are also clinically plausible. Reduced abdominal wall trauma, less manipulation of the bowel, and lower postoperative analgesic requirements may facilitate mobilization and oral intake. The WSES evidence review similarly reports shorter length of stay and earlier return to normal activity with laparoscopic appendectomy [14].

Operative time was approximately 13 minutes longer with laparoscopy. This difference should not necessarily be interpreted as a disadvantage in complicated disease. Laparoscopic inspection permits assessment of all abdominal quadrants and may facilitate identification and aspiration of collections that are less accessible through a limited right lower quadrant incision. The clinical relevance of additional operating time therefore depends on patient stability, the degree of contamination, and the surgeon's laparoscopic experience [15].

Conversion occurred in a small proportion of cases. Conversion should be regarded as a safety decision rather than a technical failure, particularly when severe inflammation obscures anatomy or safe control of the appendiceal base cannot be achieved. Current guidelines likewise support laparoscopic management of complicated appendicitis in experienced hands while maintaining a low threshold for conversion when necessary.

Conclusion

Laparoscopic appendectomy appears to be an effective surgical approach for complicated acute appendicitis when adequate expertise and equipment are available. Compared with open appendectomy, it was associated with lower postoperative pain, earlier restoration of bowel function, fewer superficial surgical-site infections, and shorter hospitalization, while the incidence of intra-abdominal abscess and reoperation remained comparable. Careful patient selection and timely conversion remain important in technically difficult cases.

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