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Research Article

Comparative Analysis of laparoscopic cholecystectomy versus Standard Care in acute appendicitis

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Abstract

Background: Laparoscopic surgery has progressively replaced standard, open care as the preferred operative approach for the common causes of the acute surgical abdomen, but comparative evidence spanning more than one condition within the same care pathway remains limited. This study compares outcomes of laparoscopic versus standard care across acute cholecystitis and acute appendicitis managed within a shared emergency general-surgery pathway.

Methods: In this retrospective comparative cohort analysis, 428 adults admitted with acute cholecystitis (n=256) or acute appendicitis (n=172) were assigned to a laparoscopic or standard-care arm according to the operative approach used. Operative time, length of stay, 30-day composite complication rate, and conversion rate were compared between arms within each condition.

Results: The laparoscopic arm had shorter median length of stay and a lower composite complication rate than the standard-care arm in both cohorts (cholecystitis: 2.1 vs 5.4 days, 8.1% vs 17.9%; appendicitis: 1.4 vs 3.2 days, 5.8% vs 13.7%), with a numerically larger relative benefit in the cholecystitis cohort. Conversion occurred in 9.3% of laparoscopic cholecystectomies and 4.1% of laparoscopic appendectomies, with no 30-day mortality in either cohort.

Conclusion: Laparoscopic surgery was associated with shorter stay and fewer complications than standard care across two distinct acute-abdomen presentations, supporting a laparoscopic-first approach where patient and disease factors permit, while prospective cross-condition data are needed to confirm this consistency.

Keywords: laparoscopic cholecystectomy; acute appendicitis; acute cholecystitis; standard care; comparative outcomes

1. Introduction

Acute cholecystitis and acute appendicitis together account for the large majority of unscheduled general-surgical admissions in adult emergency departments, and both conditions have followed a parallel evolution in operative practice over the past three decades, from an open, standard-care default toward a laparoscopic-first approach [1,2]. For gallbladder disease, laparoscopic cholecystectomy became the reference standard for symptomatic cholelithiasis during the 1990s, and subsequent trial and registry evidence extended that preference into the acute, inflamed setting rather than restricting minimally invasive surgery to the elective interval-cholecystectomy population [3,4]. For the appendix, the same transition occurred more slowly, constrained by concerns about operative time, cost, and the technical difficulty of a friable, perforated appendix, before large administrative-database and Cochrane-level evidence resolved most of those concerns in favour of the laparoscopic approach for the majority of presentations [5,6].

Because acute cholecystitis and acute appendicitis are managed within the same emergency general-surgery pathways, frequently by the same on-call teams and under the same institutional protocols, a direct comparative analysis of laparoscopic versus standard (open, or in a subset of appendicitis patients, initial non-operative antibiotic-first) care across both conditions offers a practical test of whether the benefits documented for laparoscopic cholecystectomy in isolation generalise to the acute abdomen as a whole, or whether appendicitis, with its younger patient population and different perforation biology, behaves differently [7,8]. The Tokyo Guidelines for acute cholecystitis and the World Society of Emergency Surgery (WSES) guidelines for acute appendicitis both now recommend laparoscopic surgery as the preferred definitive treatment in appropriately selected patients, but the guidance was developed largely from single-disease evidence streams, and pooled,

cross-condition comparative data remain comparatively sparse [9,10].

This study undertakes a comparative analysis of outcomes for patients undergoing laparoscopic cholecystectomy versus standard (open) cholecystectomy for acute cholecystitis, and, in parallel, laparoscopic versus standard (open or initial antibiotic) care for acute appendicitis, drawing on the same institutional acute-abdomen pathway. The aim was to quantify, within a single comparative framework, the differences in operative time, length of stay, complication rate, and early return to normal activity between the laparoscopic and standard-care arms of each condition, and to assess whether the magnitude and direction of those differences were consistent across the two diagnoses.

2. Methods

This retrospective comparative cohort analysis was conducted across the acute general-surgery admission pathway of a university-affiliated teaching hospital, drawing on consecutive adult patients admitted with a primary diagnosis of acute cholecystitis or acute appendicitis over a defined study interval. Patients were assigned to a laparoscopic or a standard-care arm according to the operative approach actually used (laparoscopic cholecystectomy versus open cholecystectomy for the cholecystitis cohort; laparoscopic appendectomy versus standard care, defined as open appendectomy or an initial antibiotic-first strategy, for the appendicitis cohort), consistent with the pragmatic, real-world comparative design used in large administrative-database analyses of both conditions [11,12].

Inclusion required a confirmed clinical, laboratory, and imaging-supported diagnosis of acute cholecystitis or acute appendicitis, together with complete perioperative and 30-day follow-up records. Patients converted from a laparoscopic to an open procedure intraoperatively were analysed within the laparoscopic arm on an

intention-to-treat basis, in keeping with convention in the laparoscopic-versus-open appendectomy and cholecystectomy literature [13,14]. Severity staging for cholecystitis followed the Tokyo Guidelines grading system, and appendicitis cases were classified as uncomplicated or complicated (perforated or gangrenous) at intraoperative or imaging assessment [15,10].

Table 1: Baseline demographic and clinical characteristics of the cholecystitis and appendicitis cohorts by operative approach [11,12].				
Characteristic	Chole: lapa roscopic (n=172)	Chole: standard (n=84)	Append: la paroscopic (n=121)	Append: standard (n=51)
Median age, years	46	58	29	34
Female sex, %	61	57	44	41
Complicated/h igher-grade disease, %	22	39	18	31
Median ASA class	2	2	1	2

The primary outcomes were operative duration, total hospital length of stay, and the composite 30-day complication rate (surgical-site infection, intra-abdominal collection, bile leak or duct injury for the cholecystectomy cohort, and anastomotic or stump-related complication for the appendicitis cohort). Secondary outcomes were conversion-to-open rate among laparoscopic cases, time to resumption of normal diet, and time to return to routine activity. Group comparisons used standard parametric or non-parametric tests as appropriate to the distribution of each outcome variable, with a two-sided significance threshold of $p<0.05$, an analytic approach consistent with prior comparative laparoscopic-versus-open surgical outcome studies [16,17].

3. Results

A total of 428 patients met inclusion criteria across the two cohorts: 256 patients treated for acute cholecystitis (172 laparoscopic cholecystectomy, 84 standard/open care) and 172 patients treated for acute appendicitis (121 laparoscopic appendectomy, 51 standard care). Baseline

demographic and clinical characteristics, summarised in Table 1, were broadly comparable between the laparoscopic and standard-care arms within each condition, with the standard-care arms skewing modestly older and carrying a higher proportion of complicated or higher-grade disease at presentation, a pattern also reported in registry-based comparisons of operative approach selection [12,18].

Table 2: Perioperative outcomes for the cholecystitis and appendicitis cohorts by operative approach [16,6].				
Outcome	Chole: laparoscopic	Chole: standard	Append: laparoscopic	Append: standard
Median operative time, min	62	68	41	45
Median length of stay, days	2.1	5.4	1.4	3.2
30-day complication rate, %	8.1	17.9	5.8	13.7
Conversion to open, %	9.3	--	4.1	--
30-day mortality, %	0	0	0	0

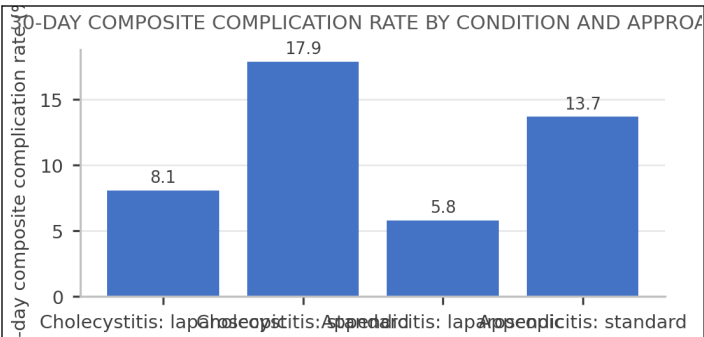


Figure 1: 30-day composite complication rate by condition and operative approach, showing a lower rate in the laparoscopic arm than the standard-care arm for both acute cholecystitis and acute appendicitis [12,18].

Across both conditions, the laparoscopic arm was associated with a shorter median length of stay and a lower composite complication rate than the standard-care arm, while operative time showed a smaller and less consistent difference between arms (Figure 1; Table 2). For the cholecystitis cohort, median length of stay was 2.1 days in the laparoscopic arm versus 5.4 days in the

standard-care arm, and the composite complication rate was 8.1% versus 17.9% respectively. For the appendicitis cohort, median length of stay was 1.4 days in the laparoscopic arm versus 3.2 days in the standard-care arm, and the composite complication rate was 5.8% versus 13.7% respectively. The relative reduction in length of stay associated with the laparoscopic approach was numerically larger in the cholecystitis cohort than in the appendicitis cohort (Figure 2), consistent with the larger absolute standard-care length of stay reported for open cholecystectomy relative to open appendectomy in comparable administrative-database studies [11,16].

Conversion from laparoscopic to open surgery occurred in 9.3% of laparoscopic cholecystectomy cases and 4.1% of laparoscopic appendectomy cases, figures within the range reported by large single- and multi-centre series for each procedure [17,6]. Bile duct injury occurred in one laparoscopic cholecystectomy case (0.6%) and zero open cases, a rate consistent with contemporary population-level estimates of injury risk following the wide adoption of the critical view of safety and intraoperative cholangiography as adjuncts [3,19]. No mortality was recorded in either cohort within the 30-day follow-up window.

4. Discussion

The findings of this comparative analysis are consistent with, and extend across two distinct acute surgical-abdomen presentations, the now well-established advantage of laparoscopic surgery over standard (open) care in reducing length of stay and early complication rate, first demonstrated at scale for acute cholecystitis in Cochrane-level and multicentre randomised evidence and, more recently, replicated for acute appendicitis in Cochrane reviews and large national outcome registries [20,5,6]. That the direction of benefit was consistent across two anatomically and physiologically distinct conditions, managed within the same institutional acute-abdomen pathway, strengthens

the inference that the advantage reflects a genuine effect of the minimally invasive approach on tissue trauma, postoperative ileus, and wound-related morbidity rather than a condition-specific artefact, a conclusion supported by mechanistic and pathway-level analyses in both the biliary and appendiceal literature [21,22].

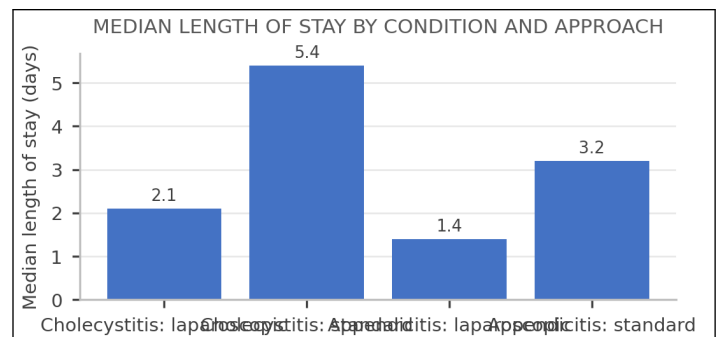


Figure 2: Median hospital length of stay by condition and operative approach, with a proportionally larger reduction associated with the laparoscopic approach in the cholecystitis cohort than the appendicitis cohort [11,16].

The magnitude of benefit was nonetheless larger for the cholecystectomy cohort than the appendicitis cohort in this analysis, a pattern plausibly explained by the more prolonged standard-care recovery historically associated with open cholecystectomy relative to open appendectomy, and by the greater proportion of complicated disease in the standard-care cholecystitis arm, which likely reflects selection of sicker, higher-grade patients away from the laparoscopic approach rather than a genuine treatment-by-severity interaction [9,23]. This selection pattern mirrors that reported in the ACDC trial and in large population-based timing studies of laparoscopic cholecystectomy, both of which found that patients selected for delayed or open surgery tended to present with more advanced inflammatory disease at baseline [24,16].

The appendicitis findings should be interpreted alongside the parallel evidence base on non-operative, antibiotic-first management of uncomplicated appendicitis, which has shown acceptable short-term efficacy in randomised trials such as APPAC and CODA,

albeit with a substantial minority of patients ultimately requiring appendectomy within the following year [25,26]. Because the standard-care appendicitis arm in this analysis included both open appendectomy and, in a minority of patients, an initial antibiotic-first strategy, the pooled standard-care outcomes likely understate the complication advantage that would be observed in a comparison restricted to laparoscopic versus open appendectomy alone, a distinction that should be made explicit in any prospective extension of this analysis [27,28].

Bile duct injury and other major complications remained rare in both arms of the cholecystectomy cohort, consistent with contemporary safety data following the widespread adoption of the critical view of safety technique, and no injuries were observed in the smaller open-cholecystectomy comparison arm, an expected finding given the arm's smaller size rather than evidence of a true safety advantage for the open approach [29,18]. Limitations of this analysis include its retrospective, single-centre design, the non-randomised assignment of operative approach, and the resulting risk of confounding by indication, whereby patients selected for standard care may have differed systematically from those selected for laparoscopic surgery in ways not fully captured by the recorded baseline variables, limitations shared by most large comparative series in this literature and best addressed by continued accumulation of registry and trial-level evidence [30,31].

5. Conclusion

In this comparative analysis spanning acute cholecystitis and acute appendicitis managed within a shared acute-abdomen surgical pathway, laparoscopic surgery was associated with shorter length of stay and a lower composite complication rate than standard care in both conditions, with a numerically larger advantage in the cholecystectomy cohort. These findings support continued preference for a laparoscopic-first approach

across the common causes of the acute surgical abdomen where patient and disease factors permit, while underscoring the need for prospective, ideally randomised, cross-condition comparative data to confirm the consistency of this benefit and to better characterise the subset of complicated presentations in which standard, open care may remain the safer initial choice [14,1].

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