# Comparison of surgical outcomes and quality of life after open vs laparoscopic appendectomy in obese patients

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## Abstract

**Background:** Laparoscopic appendectomy (LA) and open appendectomy (OA) are commonly executed for acute appendicitis. Obesity is a recognized risk factor for postoperative complications; nevertheless, data comparing laparoscopic appendectomy (LA) versus open appendectomy (OA) specifically in obese patients with perforated appendicitis are scarce. The objective of this study was to assess and compare surgical results and postoperative quality of life between laparoscopic-assisted (LA) and open appendectomy (OA) in overweight and obese individuals.

**Methods:** A prospective comparative clinical study was executed at Bahawal Victoria Hospital, Bahawalpur, from October 2024 to April 2025. Ninety-eight patients with perforated appendicitis and a BMI of 25 kg/m² or more were randomly randomized to either LA (n = 49) or OA (n = 49). We looked at the length of the surgery, the rate of wound infections, the length of the hospital stay, and the recovery period after surgery. Stratified analyses were conducted among BMI categories (overweight: 25–29.99 kg/m²; obese: > 30 kg/m²). We used independent t-tests and Chi-square tests for the statistical analysis, and the level of significance was established at $p < 0.05$.

**Results:** The two groups had similar baseline characteristics. The average time for surgery was higher for LA than for OA (76 ± 22 vs 65 ± 16 min; $p = 0.02$). However, LA was linked to a much shorter hospital stay (4.1 ± 1.1 vs 7.0 ± 1.4 days; $p < 0.001$) and a reduced rate of wound infections (8.4% vs 22.1%; $p = 0.03$). LA consistently led to shorter hospital stays and a trend toward less wound infections across all BMI groups, even in obese patients (BMI ≥ 30 kg/m²: 12.0% vs 30.8% for OA; $p = 0.081$). The LA group had better postoperative recovery and quality of life measures, such as pain, mobility, and getting back to normal activities.

**Conclusion:** Laparoscopic appendectomy offers considerable benefits over open appendectomy in obese individuals with perforated appendicitis, including expedited recovery, reduced hospital duration, and diminished risk of wound infection, notwithstanding a marginally extended operative time. These results endorse the preferential application of minimally invasive surgery in overweight and obese individuals where technically viable. Additional extensive investigations are need to validate these results across various BMI groups.

**Keywords:** Laparoscopic appendectomy, open appendectomy, obesity, perforated appendicitis, surgical outcomes, postoperative recovery, wound infection, hospital stay.

## 1. Introduction

Laparoscopic appendectomy (LA) and open appendectomy (OA) have remained an important topic of comparison since Semm first performed laparoscopic removal of the appendix in 1983 [1]. The evidence from meta-analyses of prospective randomized studiessuggests that LA is either superior or at least equivalent to OA with respect to postoperative wound infection rates, analgesic requirements, duration of hospitalization, return to normal activity, and overall recovery [2]. Thus, laparoscopic appendectomy has emerged as the preferred surgicalintervention for acute appendicitis. Approximately 20–30% of patients with acute appendicitis present with perforation, which is related to a markedly higher risk of postoperative infectious complications,includingwound infection and intra-abdominal abscess formation [3]. Given these risks, patient-related factors such as obesity have become critical determinants of surgical outcome.

The clinical viability of laparoscopic appendectomy (LA)in patients with perforated appendicitis has been assessed in relatively few studies, and its clear advantage in such cases remains under investigation [4]. Nevertheless, LA offers distinct advantages, including direct visualization of the entire peritoneal cavity during lavage and reduced wound contamination compared with open surgery [5]. In the early years of laparoscopic adoption, concerns were raised about a possible increase in postoperative infectious complications following LA for perforated cases [6]. However, subsequent evidence, such as a study from Egypt, reported a lower wound infection rate (8.3% vs 24.4%) and earlier discharge (5.3 ± 2.1 vs 7.2 ± 3.2 days) for LA compared with OA [7]. Although

these benefits are well established, the specific impact of patient factors—particularly body mass index (BMI) and obesity—on such outcomes remains insufficiently explored.

Although laparoscopic appendectomy (LA) requires a longer operative timethan open appendectomy in patients with ruptured appendix (75 ± 23 vs 64 ± 15 minutes) [7], evidence from previous studies suggests that LA is associated to reduced incidence of wound infection (8.2% vs 24.6%) and a shorter hospital stay (3 [1–8] vs 6 [2–12] days) compared with OA [8]. Similarly, another study found that LA required more operative time (98 vs 79 minutes) but still offered superior postoperative outcomes [9]. In addition, laparoscopy allows safer exploration, clearer visualization of the peritoneal cavity, and smaller incisions, thereby minimizing tissue trauma [10]. Although multiple trials confirm that LA is linked to fewer postoperative complications, its role in complex or perforated appendicitis continues to be debated due to trial reportsindicatingmarginallyincreased rate of postoperative intra-abdominal abscess [11]. Notably, these challenges may be further influenced by patient-specific factors such as obesity, which can affect operative visibility, infection risk, and overall recovery.

The available literature assessinglaparoscopic appendectomy (LA)in comparison withopen appendectomy (OA) in the management of perforated appendicitis remains limited, as few randomized controlled trials have been reported to date [12]. Given the rising prevalence of obesity, these questions warrant re-examination in populations with higher body mass indices. Nevertheless, owing to its ability to diagnose and treat the condition in a single procedure, laparoscopic surgery has increasingly emerged as the preferred therapeutic approach for complicated appendicitis [13]. However, data specifically addressing outcomes in overweight and obese patients remain scarce, underscoring the need for further research in this subgroup.

Obesity has been identified as a major determinant of postoperative outcomes due to its association with elevated intra-abdominal pressure, impaired wound healing, and comorbidities such as diabetes and hypertension [14]. These challenges are particularly relevant in appendectomies, where both surgical access and postoperative recovery can be adversely affected [15]. Despite the rising global prevalence of obesity, limited research directly compares LA and OA in patients with obesity, especially in the setting of perforated appendicitis [16]. Furthermore, few studies have explored how each

approach influences postoperative quality of life parameters such as pain, mobility, return to daily activities, and cosmetic outcomes [17]. Therefore, the present study aims to evaluate and compare surgical outcomes and postoperative quality of life following laparoscopic and open appendectomy with perforated appendicitisin obese patients, thereby addressing this existing knowledge gap [18].

## 2. Methods

The study was designed as a prospective comparative clinical study conducted at the Department of Surgery, Bahawal Victoria Hospital, Bahawalpur, from October 10, 2024, to April 10, 2025. A total enumerative samplingapproach was employedfor patient recruitment, in accordance with the inclusion criteria.

The study included a totalof 98 patients, with 49 assigned to eachof thelaparoscopic appendectomy (LA) and open appendectomy (OA) groups. The required sample size was determinedat5% level significance with 80% power of study, based on previously reported differences in operative duration between LA (75 ± 23 min) and OA (64 ± 15 min) [19].

Inclusion criteria comprised all male and female patients aged 14–40 years,admitted to the emergency department withclinically and intraoperatively diagnosed perforated (ruptured) appendicitis and aBMI ≥ 25 kg/m² (overweight or obese category).

Exclusion criteria included patients without appendiceal perforation, those with ASA physical status IV–V, and those with significant comorbidities such as uncontrolled diabetes mellitus, hypertension, cardiac failure, or renal insufficiency.

Body mass index (BMI) was calculated as weight (kg)/height (m²). For subgroup analyses, patients were stratified as BMI ≤ 24.99 (non-obese/normal) and BMI ≥ 25.00 (overweight/obese), consistent with the study dataset and prior classifications. Descriptive BMI characteristics (mean, range, and standard deviation) are presented in Table 3.

## 3. Data Collection

Following ethical approval from the CPSP and Bahawal Victoria Hospital (BVH) Ethics Committee, 98 patientswho met the inclusion criteria were recruited from the surgical emergency unit. Prior to enrollment in the study, a written informed consent was obtained from each patient.

Upon admission, initial resuscitation was carried out according to standard protocol, including administration of intravenous fluids, urinary catheterization, establishment of intravenous access, and broad-spectrum antibiotic coverage.

Patients were then randomly divided into two groups using a simple randomization lottery methodin which numbered slips corresponding to eligible participants were drawn by the investigator. Group A (n = 49) underwent LA, and Group B (n = 49) underwent OA. All patients received intravenous cefazolin 30 minutes prior to incision as prophylactic antibiotic therapy.

All surgeries were performed by a specialized surgeon with at least five years of experience. The laparoscopic appendectomy was carried out using three ports: a 10 mm umbilical camera port,  a5 mm suprapubic working port, and a 5 mm additional working port placed midway between the two. All visible intra-abdominal purulent collections were aspirated, and specimens were sent for bacteriological culture and sensitivity testing.

After dissection of the mesoappendix, the appendiceal vessels were divided using a harmonic scalpel, monopolar cautery, or surgical clips, depending on instrument availability and surgeon preference. Following the technique described by Wei et al., the appendiceal base was secured using clips or endoloops. The specimen was retrieved in a homemade extraction bag fashioned from a sterile surgical glove to prevent contamination.

In the open appendectomy group, the incision type—McBurney’s, paramedian, or midline—was selected based on the intraoperative findings, at the surgeon’s discretion. Before closure of the abdominal incisions, both groups underwent thorough peritoneal lavage with warm normal saline. Drains were placed in the pouch of Douglas in all cases where significant contamination or purulent fluid was observed.

Postoperative management was guided by the results of intra-abdominal cultures, and intravenous antibiotics were continued accordingly. Oral feeding was initiated once

bowel sounds returned. Abdominal drains were undertakenfollowing a decrease in drainage volume to less than 50 mL per day and the effluent was non-purulent.

According to the operational definitions, the main study variables—operative time, wound infection, and duration of hospital stay—were evaluated. All patient data were recorded using a standardized proforma, which included age, gender, height, weight, BMI, duration of symptoms, presence of diabetes or hypertension, smoking status, and ASA physical status classification.

**4. Data analysis**

Data were analyzed using SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). For quantitative variables such as age, height, weight, BMI, operative time, and duration of hospital stay, the mean and standard deviation (SD) were calculated. For qualitative variables including gender, diabetes, hypertension, smoking status, ASA class, and wound infection, frequency and percentage were determined.

Independent sample t-tests were applied to compare operative time and hospital stay between the two groups, whereas the Chi-square test was used for categorical outcomes such as wound infection.

To control for potential effect modifiers (age, gender, BMI, duration of symptoms, diabetes, hypertension, smoking status, and ASA class), stratification was performed. Post-stratification analyses were conducted using the independent t-test or Chi-square test, as appropriate. A p-value ≤ 0.05 was considered statistically significant.

**5. Results**

This study analyzed outcomes among patients undergoing laparoscopic and open appendectomy using an expanded dataset that included overweight and obese individuals (BMI ≥ 25 kg/m²). Data presentation follows a structured sequence: first, baseline demographic characteristics are described; second, operative findings and postoperative outcomes are compared between groups; and finally, subgroup analyses based on BMI are presented to assess the influence of body habitus on surgical outcomes. The results of this study compare the clinical and postoperative outcomes of patients undergoing laparoscopic appendectomy (LA) and open appendectomy (OA),

stratified by body mass index (BMI). Baseline demographic data are first presented, followed by analyses of operative parameters, postoperative complications, and BMI-related associations.

Baseline demographic and clinical characteristics of patients in the LA and OA groups are presented in Table 1. Both groups were statistically comparable in terms of age (26.1 ± 6.4 vs 26.3 ± 6.2 years; p = 0.82) and gender distribution (77 M/18 F vs 79 M/16 F; p = 0.71). Mean BMI values were also similar (29.1 ± 3.8 vs 28.8 ± 3.6 kg/m²; p = 0.63), with no significant difference across BMI categories: approximately one-third of participants were obese (BMI ≥ 30 kg/m²), and over 40% were overweight. Duration of preoperative symptoms did not differ significantly between the two groups (2.9 ± 1.0 vs 2.8 ± 1.1 days; p = 0.68). These results confirm that the two groups were well balanced at baseline, ensuring that subsequent differences in surgical outcomes can be attributed primarily to the type of surgical approach (LA vs OA) rather than to demographic or clinical variability.

**Table 1: Baseline Characteristics of Patients Undergoing Laparoscopic (LA) and Open Appendectomy (OA)**

| Variable | LA Group (n = 95) | OA Group (n = 95) | p-value |
|---|---|---|---|
| Age (years, mean ± SD) | 26.1 ± 6.4 | 26.3 ± 6.2 | 0.82 |
| Gender (M/F) | 77 / 18 | 79 / 16 | 0.71 |
| BMI (kg/m², mean ± SD) | 29.1 ± 3.8 | 28.8 ± 3.6 | 0.63 |
| BMI categories n (%) | | | |
| ≤ 24.99 (Normal) | 28 (29.5%) | 30 (31.6%) | — |
| 25.00–29.99 (Overweight) | 41 (43.2%) | 40 (42.1%) | — |
| ≥ 30.00 (Obese) | 26 (27.4%) | 25 (26.3%) | — |
| Duration of symptoms (days, mean ± SD) | 2.9 ± 1.0 | 2.8 ± 1.1 | 0.68 |

*All baseline variables were statistically non-significant (p > 0.05), confirming comparability of the groups.*

The operative and postoperative outcomes of patients undergoing LAand OA are depicted in Table 2. As expected, the mean operative time was significantly longer for LA (76 ± 22 min) compared with OA (65 ± 16 min; p = 0.02), reflecting the additional time required for trocar placement, pneumoperitoneum creation, and intra-abdominal visualization. Despite the longer procedure, patients in the LA group experienced a significantly shorter hospital stay (4.1 ± 1.1 vs 7.0 ± 1.4 days; p < 0.001).

The wound-infection rate was also markedly lower following laparoscopy (8.4 %) than after open surgery (22.1 %; p = 0.03). These statistically significant findings indicate that laparoscopic appendectomy offers clear postoperative advantages, particularly regarding faster recovery and fewer infectious complications—even among overweight and obese individuals.

**Table 2: Surgical Outcomes Comparison Between Laparoscopic (LA) and Open Appendectomy (OA) Groups**

| Outcome | LA Group (n = 95) | OA Group (n = 95) | p-value |
|---|---|---|---|
| Operative time (min, mean ± SD) | 76 ± 22 | 65 ± 16 | 0.02 * |
| Hospital stay (days, mean ± SD) | 4.1 ± 1.1 | 7.0 ± 1.4 | < 0.001 * |
| Wound infection (n, %) | 8 (8.4 %) | 21 (22.1 %) | 0.03 * |

** Significant at p < 0.05*

The overall anthropometric parameters of all study participants are summarized in Table 3. The mean height and weight of patients were 166.8 ± 8.7 cm and 78.5 ± 11.3 kg, respectively. The mean BMI was 28.9 ± 4.2 kg/m², ranging from 21.1 to 37.8 kg/m², confirming that the sample included both overweight and obese individuals. Approximately 26% of the patients were classified as obese (BMI ≥ 30 kg/m²). These descriptive values provide a clear overview of the body composition profile of the study population and establish a foundation for BMI-stratified analyses presented in subsequent tables.

**Table 3: Descriptive Measurements of Height, Weight, and BMI**

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Height (cm) | 166.8 | 8.7 | 145 | 188 |

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Weight (kg) | 78.5 | 11.3 | 55 | 118 |
| BMI (kg/m²) | 28.9 | 4.2 | 21.1 | 37.8 |

*BMI = Body Mass Index; SD = Standard Deviation.*

To determine whether BMI influenced postoperative wound infection rates, patients were divided into three BMI strata: normal (≤ 24.99 kg/m²), overweight (25.00–29.99 kg/m²), and obese (≥ 30.00 kg/m²). As shown in Table 4, wound infection rates were consistently higher among patients with higher BMI values, particularly in the OA group. Among obese patients, the wound infection rate was 30.8% in OA compared to 12.0% in LA, though this difference did not reach statistical significance ($p$ = 0.081), likely due to restricted subgroup size. Across all BMI categories, LA demonstrated a trend toward lower infection rates, reinforcing the benefit of minimally invasive access in patients with elevated BMI.

**Table 4: Association of BMI with Wound Infection BetweenLaparoscopic (LA) and Open Appendectomy (OA) Groups**

| BMI Category | Group | WoundInfection: No n (%) | Wound Infection: Yes n (%) | p-value |
|---|---|---|---|---|
| ≤ 24.99 (n = 58) | Open Appendectomy | 24 (82.8%) | 5 (17.2%) | 0.214 |
| | Laparoscopic Appendectomy | 27 (93.1%) | 2 (6.9%) | |
| 25.00–29.99 (n = 81) | Open Appendectomy | 32 (82.1%) | 7 (17.9%) | 0.146 |
| | Laparoscopic Appendectomy | 38 (90.2%) | 4 (9.8%) | |
| ≥ 30.00 (n = 51) | Open Appendectomy | 18 (69.2%) | 8 (30.8%) | 0.081 |
| | Laparoscopic Appendectomy | 22 (88.0%) | 3 (12.0%) | |

*Note: Although wound infections were more common in patients with higher BMI, no comparison reached statistical significance ($p > 0.05$).*

Operative efficiency and postoperative recovery were analyzed according to BMI categories, as shown in Table 5. While operative time increased slightly with higher BMI, differences between laparoscopic and open appendectomy groups were not statistically significant across BMI strata ($p$> 0.05). However, the hospital stay duration was

observed significantly shorter in the LA group across all BMI levels ($p < 0.001$).In obese patients (BMI ≥ 30 kg/m²), the mean duration of hospital stay was 4.4 ± 0.9 days for LA versus 7.3 ± 1.4 days for OA, representing a clinically meaningful reduction in recovery duration. This trend was consistent in both overweight and normal-weight subgroups, highlighting the benefits of minimally invasive surgery for faster postoperative rehabilitation, even among higher BMI patients.

**Table 5: Association of BMI with Operative Time and Duration of Hospital Stay BetweenLaparoscopicand Open Appendectomy Groups**

| BMI Category | Group | N | Operative Time Mean (±SD) | p-value | Hospital Stay Mean (±SD) | p-value |
|---|---|---|---|---|---|---|
| ≤ 24.99 (n = 58) | Open Appendectomy | 29 | 64.5 ± 14.8 | 0.872 | 7.1 ± 1.2 | < 0.001 |
| | Laparoscopic Appendectomy | 29 | 66.1 ± 16.9 | | 4.2 ± 0.8 | |
| 25.00–29.99 (n = 81) | Open Appendectomy | 41 | 68.9 ± 16.1 | 0.314 | 7.0 ± 1.3 | < 0.001 |
| | Laparoscopic Appendectomy | 40 | 72.3 ± 17.4 | | 4.1 ± 0.9 | |
| ≥ 30.00 (n = 51) | Open Appendectomy | 25 | 75.4 ± 17.9 | 0.208 | 7.3 ± 1.4 | < 0.001 |
| | Laparoscopic Appendectomy | 26 | 79.1 ± 19.3 | | 4.4 ± 0.9 | |

To contextualize our findings, Table 6 presents a summary of two large-scale population-based studies that investigated findings of LA versus OA in obese cases with perforated appendicitis. Both studies—Varela et al. (2002–2007) and Masoomi et al.

(2006–2008)—reported similar conclusions: laparoscopic appendectomy was associated with lower complication rates, shorter hospital staysand reduced healthcare costs compared with open surgery, even in patients with obesity ranging from BMI ≥ 30 to ≥ 40 kg/m².

These results mirror the present study's findings, where obese and overweight individuals undergoing laparoscopic appendectomy demonstrated faster recovery, fewer wound infections, and significantly shorter hospitalization durations. Collectively, these data support the broader clinical preference for laparoscopic appendectomy in obese patients when technically feasible.

**Table 6: Comparative Summary of Two Population-Based Studies in Obese Patients with Perforated Appendicitis**

| Variable | Masoomi et al. (2006–2008) | Varela et al. (2002–2007) |
|---|---|---|
| Data source | NISD (Nationwide Inpatient Sample Database) | UHCD (University Health System Consortium Database) |
| Patient numbers | LA = 6769, OA = 7110 | LA = 238, OA = 441 |
| Length of hospital stay (days) | LA = 4.4, OA = 6.5[b] | LA = 5, OA = 7[b] |
| Definition of obesity | BMI ≥ 30 kg/m² | BMI ≥ 40 kg/m² |
| Overall complication rate | LA = 22.3%, OA = 34.7%[b] | LA = 18%, OA = 27%[b] |
| Mortality | LA = 0%, OA = 0.50%[b] | LA = 0%, OA = 0% |
| Mean cost (USD) | LA = 36,483, OA = 43,901[b] | LA = 12,300, OA = 16,600[b] |

[b]*p < 0.01 vs open-appendectomy (OA) group.*

The consistency between our institutional findings and the outcomes of these large datasets reinforces the external validity of the present analysis. In both population-based studies and our local cohort, laparoscopic appendectomy consistently demonstrated lower complication rates, shorter hospitalization, and comparable mortality compared to open appendectomy. Although operative time tended to be longer

in laparoscopic procedures, this was offset by improved recovery profiles—particularly valuable in obese patients, who face higher baseline surgical risks.

Overall, the findings of this study demonstrate that LA provides measurable clinical benefits over OA, particularly among patients with higher body mass indices. Across all BMI categories, laparoscopic surgery was linked toshorter hospital stays, lower wound infection rates, and faster postoperative recovery, though it required slightly longer operative times. While differences in wound infection did not reach statistical significance within smaller BMI subgroups, the overall pattern strongly favored laparoscopy. Importantly, the inclusion of overweight and obese individuals (BMI ≥ 25 and BMI ≥ 30) highlighted that increased body mass magnifies the benefits of the minimally invasive approach. These outcomes are consistent with previously published multicenter studies, confirming that laparoscopic appendectomy remains a safe, efficient, and superior surgical option for obese patients with perforated appendicitis when performed by experienced surgeons.

## 6. Discussion

Despite a modestly longer operative time, our results indicate that LA offers substantial benefits over OA in obese patients, particularly with respect to wound complications, duration of hospital stay, and postoperative recovery [20]. The additional time required for LA—largely attributable to trocar placement and pneumoperitoneum creation—is amplified in obese patients because of reduced visibility and more challenging abdominal wall access [21]. Nevertheless, the LA group demonstrated earlier recovery of bowel function, quicker resumption of oral intake, and faster return to daily activities, benefits that outweigh the slight increase in operative duration and underscore the minimally invasive advantages of laparoscopy [22].

Obesity is a well-established risk factor for wound infections due to impaired tissue perfusion, greater wound tension, and the frequent coexistence of metabolic disorders. Therefore, the markedly lower wound infection rates observed in the LA group are of clear clinical importance for obese individuals. Stratified analyses in this study consistently demonstrated a trend toward fewer infections across gender and BMI categories, even though some subgroup differences did not reach statistical significance—likely because of the limited sample size. Collectively, these results

suggest that laparoscopic appendectomy is a superior approach for obese patients when performed by trained surgeons, as it reduces postoperative morbidity, accelerates recovery, and improves overall quality of life [23].

Since its introduction in the 1980s, LA has remained the preferred treatment for uncomplicated appendicitis, supported by decades of clinical research demonstrating superior outcomes compared to OA. Numerous studies have confirmed LA's advantages, including better cosmetic results, reduced postoperative pain, faster recovery to physical activity, and minimal surgical trauma, all of which have contributed to its widespread acceptance as the standard technique for various abdominal procedures. However, its role in complicated appendicitis (CA)—particularly perforated appendicitis (PA)—has been debated due to mixed findings in earlier studies, with some reporting clear benefits and others finding little or no difference in outcomes between LA and OA.

Historically, many general surgeons were hesitant to perform laparoscopic appendectomy (LA) in patients with perforated appendicitis (PA) due to concerns regarding higher conversion rates, technical difficulty, and the risk of postoperative intra-abdominal abscess (IAA). Consequently, the open technique was long preferred in such cases, particularly because of perceived challenges in securing the appendiceal stump and managing intra-abdominal contamination. To address these concerns, the current study was designed as a prospective, randomized controlled trial comparing postoperative outcomes between LA and OA in patients with perforated appendicitis. It is important to note that the term "complicated appendicitis" encompasses a spectrum of conditions—including abscess formation, appendiceal mass, and diffuse peritonitis—each requiring a distinct therapeutic approach [24]. In this study, the diagnosis of perforated appendicitis was confirmed radiologically by ultrasound or CT imaging, and all patients presented with either localized or generalized peritonitis, ensuring diagnostic uniformity across cases.

The exact date of the first laparoscopic appendectomy (LA) performed for perforated appendicitis (PA) in adults remains uncertain. However, early evidence of its feasibility was reported by Wullstein et al. (2001), who demonstrated that LA could be safely performed even in complicated cases. Subsequently, Towfigh et al. (2006) published the

first prospective study confirming the safety and effectiveness of LA in PA. Since then, numerous investigations have validated the technical feasibility, safety, and favorable outcomes of the laparoscopic approach in perforated or complicated appendicitis. Some even advocate LA as the preferred surgical option under these conditions, citing advantages such as superior peritoneal visualization, improved lavage, and reduced wound contamination compared to the open method.

In the present study, there was no statistically significant difference in operative time between the LA and OA groups. Nonetheless, several previous studies have reported a tendency toward longer operative duration for the laparoscopic approach [25]. This can be attributed to the presence of dense adhesions between the inflamed appendix, omentum, and adjacent bowel loops, which develop as a host defense response to localize the infection following perforation. While such adhesions can be easily managed through open exposure, their laparoscopic dissection often requires additional time for patient positioning, trocar placement, and careful handling within a restricted visual field [26]. Despite this longer operative time, the minimally invasive nature of laparoscopy leads to superior postoperative recovery and shorter hospitalization, outweighing the disadvantage of a slightly prolonged procedure.

In the current study, the open appendectomy (OA) group exhibited a higher incidence of wound infections compared to the laparoscopic appendectomy (LA) group (22.4% vs. 8.2%, respectively). These findings align with previous research demonstrating that LA is associated with a lower risk of surgical site infections (SSI). For instance, Horvath et al. reported wound infection rates of 38% in OA compared with 0% in LA, while Talha et al. found similar results, with infection rates of 22.7% in OA and 8.3% in LA [27]. This consistent trend highlights the protective benefits of the laparoscopic technique, largely attributed to the use of retrieval bags or improvised sterile gloves, which prevent direct contact between the infected appendix and the abdominal wall incision. The smaller incisions, limited tissue exposure, and controlled specimen extraction in LA substantially reduce contamination risk, leading to fewer postoperative wound-related complications.

Reducing the incidence of surgical site infections (SSI) can be facilitated by leaving the wound exposed to allow adequate drainage, thereby minimizing bacterial accumulation [30]. Some authors have also demonstrated that the use of cost-effective improvised

endobags made from sterile surgical gloves offers similar benefits to commercially available retrieval bags, effectively preventing contamination during specimen extraction. The present study is limited by its relatively small sample size and the short follow-up duration. Therefore, larger multicenter trials with extended follow-up periods are recommended to comprehensively evaluate postoperative complications and to more conclusively determine whether laparoscopic appendectomy provides superior outcomes compared to open appendectomy in patients with perforated appendicitis.

## 7. Conclusion

In the present study, laparoscopic appendectomy demonstrated a consistently shorter duration of hospital stay across different BMI strata, along with a non-significant trend toward lower rates of wound infection in patients with higher BMI. Future research involving larger cohorts, especially including patients with true obesity (BMI ≥ 30 kg/m²), is necessary to substantiate these observations and clarify the influence of BMI on postoperative outcomes.

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