IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 10 Ser. 1 (October. 2025), PP 83-87
www.iosrjournals.org

Wound Infection Is Less Common in Case of Laparoscopic Appendectomy than Open Appendectomy

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ABSTRACT
Background: *Surgical site infections (SSIs) are common postoperative complications that increase morbidity, hospital stay, and healthcare costs. Laparoscopic appendectomy (LA) is suggested to reduce SSIs compared to open appendectomy (OA) due to smaller incisions and minimal tissue handling.*
Aim of the study: *To compare postoperative wound infection rates between laparoscopic and open appendectomy and evaluate associated operative and clinical outcomes.*
Methods: *A retrospective cross-sectional study was conducted at Department of Surgery, Community Based Medical College, Mymensingh, Bangladesh January 2021 to December 2022, including 44 patients who underwent appendectomy for acute appendicitis (LA, n=22; OA, n=22). Data on demographics, co-morbidities, appendix pathology, operative outcomes, and postoperative wound infections were collected and analyzed using SPSS v26. P-values <0.05 were considered significant.*
Result: *Overall wound infection was significantly lower in the LA group compared to OA (4.55% vs. 18.18%, p=0.04). LA patients also had reduced intraoperative blood loss (35 vs. 80 mL; p=0.03) and shorter hospital stay (4 vs. 6 days; p<0.001). Operative time, co-morbidities, and appendix pathology were comparable between groups.*
Conclusion: *Laparoscopic appendectomy significantly reduces postoperative wound infections, blood loss, and hospital stay compared to open appendectomy, supporting its use as the preferred surgical approach for acute appendicitis.*
Keywords: *Laparoscopic appendectomy, Open appendectomy, Surgical site infection, Acute appendicitis, Postoperative outcomes*

I. INTRODUCTION

A wound infection, or surgical site infection (SSI), is an infection occurring at or near a surgical incision within 30 days post-surgery or 90 days if an implant is used. It is caused by microorganisms, mainly bacteria, leading to redness, swelling, pain, pus, or delayed healing. SSIs can be superficial, such as skin and subcutaneous tissue, or deep, affecting muscles, fascia, or organs, and are common postoperative complications that increase morbidity and healthcare costs [1-3]. Globally, wound infections are less common after laparoscopic appendectomy than open appendectomy due to smaller incisions and minimal tissue handling. Studies consistently show lower postoperative infection rates with laparoscopic surgery. Laparoscopic appendectomy reduced the risk of surgical site infection, and minimally invasive techniques lower infection risks by minimizing wound exposure to external contaminants [1,4]. In Bangladesh, studies report lower wound-infection rates after laparoscopic than open appendectomy, likely due to smaller incisions and less tissue exposure, with local prospective and retrospective series showing fewer superficial surgical-site infections, shorter hospital stays, and faster recovery after laparoscopy [5,6]. Fewer wound infections mean less wound care, less drainage, and fewer interruptions. Patients tend to leave the hospital earlier and return to normal activities sooner. Meta-analyses show that laparoscopic appendectomy yields shorter hospital stays. Even in cases of perforated appendicitis or complicated inflammation, the benefits in wound infection reduction persist. Laparoscopic appendectomy had lower SSI rates than open in complicated/perforated appendicitis [7]. Beyond clinical and economic consequences, SSIs also have substantial psychosocial impacts. Patients frequently experience anxiety, stress, and reduced quality of life due to persistent pain, wound care requirements, scarring, and delayed return to work or daily activities [9]. For children

and adolescents, prolonged recovery can interfere with schooling and social activities, further affecting psychological well-being. Additionally, SSIs may contribute to increased use of broad-spectrum antibiotics, raising the risk of antimicrobial resistance, which has long-term public health implications [10]. Several factors increase the risk of surgical site infections (SSIs) following appendectomy, whether laparoscopic or open. Patient-related factors such as diabetes mellitus, obesity, advanced age, immunosuppression, and poor nutritional status can impair immune function and delay wound healing [8]. Microbiological factors, such as perforated appendicitis with a high bacterial load and inadequate perioperative antibiotic prophylaxis, further elevate the risk of infection [11]. Awareness of these risk factors allows surgeons to implement preventive strategies, such as optimizing patient nutrition and glucose control, minimizing operative time, and adhering to strict sterile techniques, to reduce the incidence of SSIs [8,9]. Prevention of surgical site infections (SSIs) after appendectomy involves a combination of patient optimization, surgical technique, and perioperative management. Proper preoperative patient preparation, including glycemic control in diabetics, treatment of malnutrition, and management of immunosuppressive conditions, reduces susceptibility to infections [12]. Perioperative antibiotic prophylaxis, administered at the appropriate time and with correct dosing, has been shown to substantially lower SSI incidence, particularly in complicated appendicitis [11].

This study aimed to compare the incidence of postoperative wound infection between laparoscopic and open appendectomy and to identify factors contributing to surgical site infections in patients undergoing appendectomy.

II. METHODOLOGY & MATERIALS

This was a retrospective cross-sectional study carried out conducted at Department of Surgery, Community Based Medical College, Mymensingh, Bangladesh January 2021 to December 2022. A total of 44 patients who underwent appendectomy for acute appendicitis were included and divided into two groups: 22 patients treated by laparoscopic approach and 22 by open surgery.

Inclusion Criteria:

- Patients aged ≥10 years who underwent appendectomy for acute appendicitis.
- Both laparoscopic and open surgical approaches performed during the study period.
- Availability of complete clinical, operative, and postoperative data.

Exclusion Criteria:

- Patients with incidental or negative appendectomy.
- Cases with generalized peritonitis requiring other surgical procedures.
- Immunocompromised patients or those on long-term corticosteroid therapy.

Ethical Considerations

Written informed consent was obtained from all participants or their legal guardians after explaining the purpose, procedure, potential benefits, and possible risks of the study. All ethical guidelines were strictly followed, ensuring confidentiality through secure data storage (password-protected computer and separate physical files).

Surgical Procedures

The choice between open and laparoscopic appendectomy was determined by the operating surgeon after discussing the surgical options with the patient. All operations were performed under general anesthesia using standard aseptic techniques. Prophylactic antibiotics, including cefuroxime (1.5 g) and metronidazole (500 mg), were administered at the time of induction. Postoperatively, all patients received a five-day course of antibiotics as part of routine infection prevention. Patients were generally discharged within 24 to 72 hours after surgery, depending on their clinical condition and personal preference.

Follow-up

Postoperative follow-up was ensured for one month. Patients were reviewed in the outpatient department (OPD) or contacted via telephone at 2 weeks and 1 month after surgery. Follow-up focused on identifying any postoperative complications, particularly wound infections, and assessing overall recovery.

Data Collection

Data were collected using a structured checklist based on hospital records and patient follow-up information. The recorded parameters included baseline characteristics such as age and gender, along with preoperative laboratory findings, including C-reactive protein (CRP) and white blood cell (WBC) count. Relevant co-morbidities such as diabetes, hypertension, or COPD were also documented. Intraoperative findings were

noted, with appendix pathology categorized as hyperemic, suppurative, gangrenous, or perforated/abscess. Operative outcomes, including operating time, intraoperative blood loss, and duration of hospital stay, were carefully recorded. Postoperative outcomes were assessed by identifying any wound infection, classified as superficial or deep, based on clinical evaluation during hospital stay and subsequent follow-up visits.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation or median (range) and compared using the independent t-test or Mann–Whitney U test as appropriate. Categorical variables were presented as frequencies and percentages. Categorical variables were compared using the Chi-square test or Fisher's exact test. A p-value < 0.05 was considered statistically significant.

III. RESULT

The mean age was 33.54 ± 17.76 years in the LA group and 36.38 ± 19.43 years in the OA group (p = 0.14). Females comprised 63.6% of the LA group and 68.2% of the OA group (p = 0.61). The median C-reactive protein (CRP) level was significantly lower in the LA group [1.8 mg/dL (0.05–18.5)] compared to the OA group [4.2 mg/dL (0.10–25.6)] (p = 0.03), while median white blood cell (WBC) counts showed no significant difference between groups (p = 0.23) (Table 1). Comorbidities were comparable between groups, with similar rates of diabetes (9.1%), slightly higher hypertension in OA (18.2% vs. 13.6%), and marginally higher COPD in LA (13.6% vs. 9.1%) (Figure 1). Hyperemic appendicitis was observed in 36.4% of LA cases and 31.8% of OA cases, whereas suppurative appendicitis was the most common finding in both groups (40.9% in LA vs. 45.5% in OA). Gangrenous appendicitis occurred in 13.6% of LA and 9.1% of OA cases, and perforated or abscessed appendicitis was found in 9.1% and 13.6% of cases, respectively. The differences in pathological distribution between the two groups were not statistically significant (p = 0.71) (Table 2). Operative outcomes showed that the median operating time was slightly shorter in the laparoscopic appendectomy (LA) group [58 minutes (30–110)] compared to the open appendectomy (OA) group [65 minutes (38–130)], though the difference was not statistically significant (p = 0.42). Median blood loss was significantly lower in the LA group [35 mL (10–120)] than in the OA group [80 mL (20–250)] (p = 0.03). Additionally, patients who underwent LA had a significantly shorter hospital stay [4 days (2–8)] compared to those who underwent OA [6 days (3–12)] (p < 0.001) (Table 3). Overall, wound infection occurred in 4.5% of LA cases and 18.2% of OA cases, showing a statistically significant difference (p = 0.04). Superficial infections were noted in 4.5% of LA and 13.6% of OA patients (p = 0.29), while deep infections occurred only in the OA group (4.5%), though this difference was not statistically significant (p = 0.31) (Table 4).

Table 1: Baseline characteristics of the study population

Variables	LA (n=22)		OA (n=22)		P-value
	n	%	n	%	
Age (years), Mean ± SD	33.54 ± 17.76		36.38 ± 19.43		0.14
Gender					
Female	14	63.64	15	68.18	0.61
Male	8	36.36	7	31.82	
CRP (mg/dL), Median (Range)	1.8 (0.05–18.5)		4.2 (0.10–25.6)		0.03
WBC (×10³/mL), Median (Range)	12.6 (5.0–20.8)		13.4 (5.5–22.6)		0.23

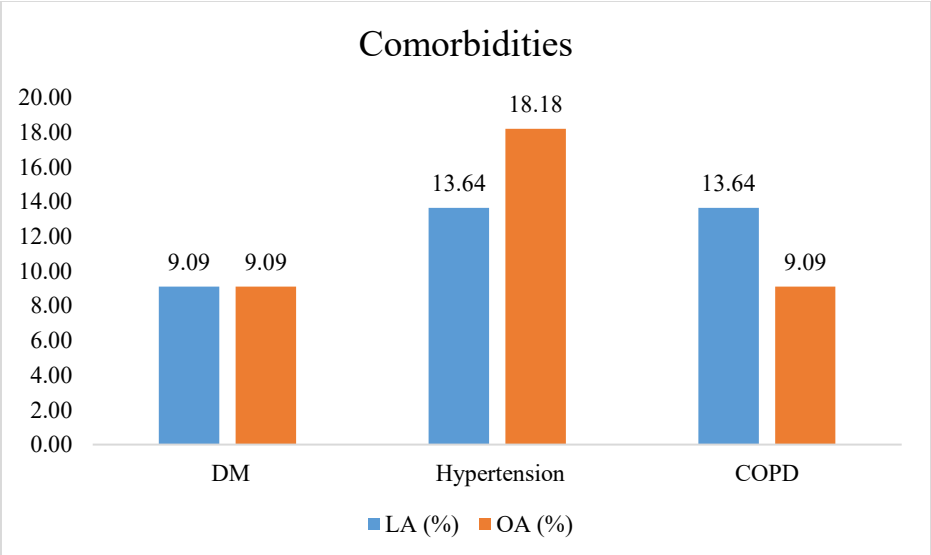

Figure 1: Co-morbidities among patients of two groups

Table 2: Appendix pathology in Laparoscopic (LA) and Open Appendectomy (OA)

Appendix pathology	LA (n=22)		OA (n=22)		P-value
	n	%	n	%	
Hyperemic	8	36.36	7	31.82	0.71
Suppurative	9	40.91	10	45.45	
Gangrenous	3	13.64	2	9.09	
Perforated / Abscess	2	9.09	3	13.64	

Table 3: Operative outcomes between Laparoscopic (LA) and Open Appendectomy (OA)

Variables	LA, Median (Range)	OA, Median (Range)	P-value
Operating time (minutes)	58 (30–110)	65 (38–130)	0.42
Blood loss (mL)	35 (10–120)	80 (20–250)	0.03
Hospital stay (days)	4 (2–8)	6 (3–12)	<0.001

Table 4: Postoperative wound infection rates in Laparoscopic (LA) and Open Appendectomy (OA)

Infection Type	LA (n=22)		OA (n=22)		P-value
	n	%	n	%	
Any wound infection	1	4.55	4	18.18	0.04
Superficial infection	1	4.55	3	13.64	0.29
Deep infection	0	0.00	1	4.55	0.31

IV. DISCUSSION

This comparative study evaluated the outcomes of laparoscopic appendectomy (LA) and open appendectomy (OA) across operative parameters and postoperative complications. The results revealed that laparoscopic surgery offered advantages in terms of reduced blood loss, shorter hospital stay, and lower wound infection rates, with comparable operative time and pathology profiles between groups. The demographic characteristics of both groups, showing no significant difference in age (33.54 ± 17.76 vs. 36.38 ± 19.43 years; $p = 0.14$) or gender distribution ($p = 0.61$). These findings align with those reported by Khazaal et al., who found no demographic differences between LA and OA groups, indicating comparable baseline characteristics and minimizing selection bias [13]. The median CRP was significantly lower in the LA group (1.8 mg/dL vs. 4.2 mg/dL; $p = 0.03$), suggesting a lesser inflammatory response, consistent with Schwenk et al., who demonstrated that laparoscopic procedures produce reduced systemic inflammation compared to open surgery [14]. Comorbidities such as diabetes, hypertension, and COPD were evenly distributed between groups, supporting the comparability of patient risk profiles. Similar findings were noted by Takami et al., who also reported no significant differences in baseline comorbidities between laparoscopic and open appendectomy cohorts [15]. The histopathological spectrum of appendiceal inflammation showed a similar distribution of hyperemic, suppurative, gangrenous, and perforated appendicitis between the two groups ($p = 0.71$). This concordance suggests that operative outcomes were not confounded by disease severity. Bhosle et al. similarly found no significant pathological differences between groups in their prospective comparative study of complicated appendicitis [16]. The operative time was comparable between LA and OA (58 min vs. 65 min; $p = 0.42$). Although early literature reported longer times for laparoscopy due to the learning curve, recent studies—including Mán et al.—have shown reduced or equivalent durations once proficiency is achieved [17]. Our result supports this trend, suggesting that laparoscopic appendectomy has become a time-efficient technique in experienced hands. Blood loss was significantly lower in the LA group (35 mL vs. 80 mL; $p = 0.03$), consistent with findings from Yu et al., who also observed less intraoperative bleeding during laparoscopy due to enhanced visualization and minimal tissue trauma [18]. Moreover, the mean hospital stay was significantly shorter in LA (4 days vs. 6 days; $p < 0.001$), which parallels multiple studies showing that laparoscopic appendectomy facilitates faster recovery and earlier discharge. Biondi et al. both reported similar outcomes, attributing shorter hospitalization to smaller incisions, reduced postoperative pain, and quicker return of bowel function [19]. Wound infection rates were significantly lower in LA (4.55%) compared to OA (18.18%) ($p = 0.04$). This is consistent with a meta-analysis by Güler et al., which reported infection rates of 6.8% for LA versus 15.9% for OA. [20]. The lower infection rate in laparoscopic surgery is likely due to smaller incisions and reduced exposure of the surgical site to external contamination.

Limitations of the study: This study is limited by its retrospective cross-sectional design and single-center setting, which may affect the generalizability of the findings. The small sample size (n=44) reduces statistical power and may not capture all potential risk factors for wound infection. Follow-up was limited to one month, potentially underestimating late-onset surgical site infections. Additionally, surgeon experience, variations in perioperative care, and patient compliance with postoperative instructions were not controlled, which could influence outcomes.

V. CONCLUSION

This study demonstrates that laparoscopic appendectomy is associated with a significantly lower overall postoperative wound infection rate compared to open appendectomy (4.55% vs. 18.18%, p = 0.04). Patients undergoing laparoscopy also experienced reduced intraoperative blood loss and shorter hospital stays, highlighting the clinical benefits of minimally invasive surgery. Although operative time and co-morbidities were comparable between groups, the findings reinforce the role of laparoscopic appendectomy in minimizing surgical site infections and promoting faster recovery. These results align with global and regional studies reporting lower SSI rates and improved postoperative outcomes with laparoscopic approaches, emphasizing its value as the preferred surgical technique for acute appendicitis whenever feasible.

Funding: *No funding sources*
Conflict of interest: *None declared*
Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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