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Research Article

A Comparative Study of Laparoscopic Appendectomy Specimen Retrieval Using Plastic Endo-Bag versus Direct Removal through 10mm Umbilical Port

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Abstract
Background: Acute appendicitis is one of the most common surgical emergencies, often managed by laparoscopic appendectomy due to its advantages of less postoperative pain, faster recovery, and shorter hospital stay compared to open surgery. However, the optimal technique for specimen retrieval—whether using a plastic Endo Bag or direct extraction through the umbilical port—remains debated, particularly regarding infection prevention and operative efficiency.
Aim: To compare two techniques of laparoscopic appendectomy specimen retrieval—Plastic Endo Bag Method and Direct Retrieval through the 10 mm Umbilical Port—in terms of clinical characteristics, mean operation time, specimen extraction time, first passage of flatus, and length of hospital stay.
Materials and Methods: A prospective observational study was conducted in the Department of General Surgery at a tertiary care hospital, involving 50 patients diagnosed with acute appendicitis. Participants were alternately allocated into two equal groups: Group A (Endo Bag retrieval) and Group B (Direct umbilical port retrieval). Operative time, extraction time, postoperative recovery parameters, and surgical site infections were recorded and statistically analyzed, with $p < 0.05$ considered significant.
Results: Of the 50 patients studied, the majority were between 21–30 years of age with nearly equal gender distribution. Mean operation and specimen extraction times were significantly shorter in Group B compared to Group A ($p < 0.05$ and $p < 0.001$, respectively). The first passage of flatus occurred on postoperative day one in most patients, and the mean hospital stay was similar in both groups. Although port-site infections were slightly more frequent in Group B, the difference was not statistically significant ($p = 0.157$).
Conclusion: Direct umbilical port retrieval of the appendix reduced operative and extraction times without adversely affecting postoperative recovery when compared to Endo Bag use. While Endo Bag retrieval may offer a marginal reduction in wound contamination risk, both techniques demonstrated comparable clinical outcomes.

Keywords: Appendicitis, Laparoscopic Appendectomy, Endo Bag, Specimen Retrieval, Umbilical Port, Surgical Site Infection.

INTRODUCTION

Acute appendicitis, or inflammation of the vermiform appendix, remains one of the most frequently encountered surgical emergencies in general surgical practice. It commonly results from obstruction of the appendiceal lumen by fecoliths, parasites, tumors, foreign bodies, or microbial agents, leading to a cascade of inflammatory changes. The lifetime risk of developing acute appendicitis is estimated to be 7–8%, with variations observed across different age groups and genders (1). Appendicectomy—the surgical removal of the inflamed appendix—remains the definitive treatment and is among the most commonly performed emergency surgeries worldwide (2).

The surgical management of appendicitis has evolved significantly with the introduction of minimally invasive techniques. Laparoscopic appendectomy has largely replaced the traditional open approach due to its well-established benefits, including smaller incisions, less postoperative pain, shorter hospital stays, faster recovery, and improved cosmetic outcomes (3). Conventional laparoscopic appendectomy typically employs three or four

ports, while recent innovations have introduced single-site and multichannel port techniques to further minimize surgical trauma (4). Despite these advances, the extraction of the inflamed appendix from the abdominal cavity during laparoscopic surgery remains a crucial step, as improper retrieval may increase the risk of contamination and surgical site infections (5).

Specimen retrieval in laparoscopic appendectomy is most commonly performed through the umbilical port, either directly or using a retrieval device such as an Endoplastic bag. The use of retrieval bags has been advocated to minimize contamination of the abdominal wall and reduce postoperative infections, particularly in cases of complicated appendicitis (6). However, the necessity and effectiveness of routine retrieval bag use remain controversial. Several studies have reported conflicting outcomes—some demonstrating a reduction in superficial SSI and intra-abdominal abscess rates with bag use, while others have found no significant benefit compared to direct extraction through the port (7–10).

In recent years, various retrieval devices and cost-effective alternatives, such as the use of sterile surgical glove cuffs, have been explored to achieve similar results at reduced cost (11,12). While some trials have highlighted the efficacy of these low-cost methods in preventing infection, others have questioned their impact on operative duration, extraction time, and overall surgical outcomes. Consequently, the decision to use a retrieval bag or direct port extraction continues to depend largely on surgeon preference, local protocols, and intraoperative findings (9).

Given the ongoing debate, this study aims to compare the operative outcomes of patients undergoing laparoscopic appendectomy with two different specimen retrieval techniques—Endoplastic bag retrieval versus direct 10 mm umbilical port retrieval. The comparison will focus on parameters such as mean operative time, specific extraction time, and postoperative complications, including surgical site infection rates. Through this analysis, the study seeks to clarify whether retrieval bag use confers measurable clinical advantages, thereby contributing valuable evidence to optimize laparoscopic appendectomy practices (7–10).

METHODOLOGY

Study Design

The present study was designed as a prospective observational study conducted to compare the operative outcomes between two specimen retrieval methods used during laparoscopic appendectomy—the Plastic Endo-Bag Retrieval Method and Direct 10 mm Umbilical Port Retrieval Method.

Study Setting and Duration

The study was carried out in the Department of General Surgery, Narayana Medical College and Hospital, Chinthareddypalem, Nellore, over a period of 6 months from january 2025 to june 2025. All procedures were performed under the supervision of experienced surgeons trained in laparoscopic surgery.

Sample Size

A total of 50 patients clinically diagnosed with acute appendicitis and scheduled for laparoscopic appendectomy were included in the study. Patients were recruited consecutively until the desired sample size was achieved.

Source of Data

Data were obtained from patients admitted to the Department of General Surgery, Narayana Medical College and Hospital, who met the inclusion criteria. All relevant data were collected from patient medical records, operative notes, and postoperative follow-up evaluations.

Inclusion Criteria

1. Patients with a clinical diagnosis of acute appendicitis confirmed by ultrasonography or other imaging modalities.
2. Patients who were willing to undergo laparoscopic appendectomy.
3. Patients aged above 10 years, irrespective of gender.

Exclusion Criteria

1. Patients diagnosed with other causes of acute abdomen (e.g., cholecystitis, perforated ulcer, mesenteric adenitis).
2. Patients unfit for general anesthesia or laparoscopic surgery due to comorbid conditions.
3. Patients who refused surgical intervention or did not provide informed consent.

Grouping of Participants

Eligible participants were divided into two groups based on the method of specimen retrieval employed during laparoscopic appendectomy:

- **Group A:** Laparoscopic appendectomy with specimen retrieval using a Plastic Endo-Bag.
- **Group B:** Laparoscopic appendectomy with direct specimen retrieval through a 10 mm umbilical port.

Patients were allocated alternately into the two groups to ensure balanced distribution and to minimize selection bias.

Surgical Procedure

All patients underwent laparoscopic appendectomy under general anesthesia using the conventional three-port technique.

- A 10 mm umbilical port was used for the laparoscope, and 5 mm working ports were placed in the suprapubic and left iliac regions.
- The appendix was identified, skeletonized, and divided after ligation or application of endoloops.
- In Group A, the resected appendix was placed in a sterile Plastic Endo-Bag, which was carefully withdrawn through the umbilical port to minimize contamination and prevent spillage of infected contents.
- In Group B, the appendix was retrieved directly through the 10 mm umbilical port without the use of a retrieval bag.
- The abdominal cavity was thoroughly irrigated, hemostasis ensured, and ports closed after desufflation.

Postoperative Care and Follow-Up

All patients received standard postoperative care, including antibiotics, analgesics, and early mobilization. Patients were allowed oral intake after the return of bowel sounds.

- Patients were observed for a minimum of three days postoperatively and discharged once clinically stable.
- Follow-up evaluations were conducted at 1 week, and subsequently every 15 days for one month to assess wound healing and monitor for postoperative complications such as port-site infection, intra-abdominal abscess, or delayed bowel function.

Study Variables

The following parameters were assessed and compared between the two groups:

1. Mean Operation Time (minutes)
2. Specimen Retrieval/Extraction Time (minutes)
3. Port-Site Infection (presence/absence)
4. First Passage of Flatus (Postoperative Day 0 or 1)
5. Length of Hospital Stay (days)

Ethical Considerations

The study was conducted following the ethical principles outlined in the Declaration of Helsinki (2013). Prior to commencement, Institutional Ethics Committee (IEC) approval was obtained from Narayana Medical College & Hospital (protocol number = NMC/Adm/Ethics/Approval/005/05/2025 and date of approval = May 10, 2025). All participants were provided detailed information regarding the nature, purpose, and risks of the study, and informed written consent was obtained from each patient.

Statistical Analysis

All data were compiled and analyzed using Microsoft Excel and SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics such as mean, standard deviation (SD), and percentages were calculated for continuous and categorical variables.

- Independent Samples t-test was used to compare the mean values of continuous variables (operation time, retrieval time, and hospital stay).
- Chi-square test was applied for categorical variables (port-site infection and first passage of flatus).
  A p-value < 0.05 was considered statistically significant at a 95% confidence interval (CI).

A total of 50 patients were included, with 25 in each group (A and B). The majority of patients in both groups were in the 21–30 years age range, accounting for 23 (46%) of the total study population. The 11–20 years age group included 20 patients (40%), while the >30 years group comprised 7 patients (14%). Overall, the age distribution between the two groups was comparable.(table-1)

Table 1: Age Distribution among both groups

Age (in years)	Group A	Group B	Total
11 – 20 years	11	9	20
21 – 30 years	11	12	23
> 30 years	3	4	7
Total	25	25	50

Out of 50 patients, 26 (52%) were males and 24 (48%) were females. In Group A, males slightly outnumbered females (14 vs. 11), whereas in Group B, females were slightly more

represented (13 vs. 12). The gender distribution between the two groups was nearly equal.(table 2)

Table 2: Gender Distribution among both groups

Gender	**Group A**	**Group B**	**Total**
Male	14	12	26
Female	11	13	24
Total	25	25	50

The majority of surgeries in Group B were completed within 40 minutes (19 cases, 76%), whereas in Group A, most surgeries (14 cases, 56%) lasted between 41–50 minutes. Statistical analysis using both the Independent Samples t-test and One-way ANOVA revealed a significant difference in mean operation time between the two groups ($p = 0.026$), indicating that Group B had a shorter mean operation time compared to Group A.(table =3)

Table 3: Mean Operation Time (in minutes) among both groups

Operation Time (minutes)	**Group A**	**Group B**	**Total**
Up to 40 minutes	10	19	29
41–50 minutes	14	5	19
>50 minutes	1	1	2
Total	25	25	50

Independent Samples t-test: $t(48) = 2.292$, $p = 0.026$ (significant)
One-way ANOVA: $F(48) = 5.254$, $p = 0.026$ (significant)
In Group B, the majority of specimens (22 out of 25; 88%) were extracted within 3 minutes, while in Group A, most extractions (15 out of 25; 60%) took 3–5 minutes. Statistical analysis using both the Independent Samples t-test and One-way ANOVA showed a highly significant difference ($p < 0.001$) between the two groups. This indicates that specimen extraction was significantly faster in Group B compared to Group A.(table-4)

Table 4: Specimen Extraction Time (in minutes) among both groups

Specimen Extraction Time (minutes)	Group A	Group B	Total
Up to 3 minutes	7	22	29
3 – 5 minutes	15	3	18
More than 5 minutes	3	0	3
Total	25	25	50

Independent Samples t-test: $t(36.5) = 5.091$, $p < 0.001$ (significant)
One-way ANOVA: $F(48) = 25.92$, $p < 0.001$ (significant)
The first passage of flatus occurred predominantly on Post-operative Day 1 in both groups — 20 patients (80%) in Group A and 19 patients (76%) in Group B. A smaller number of patients passed flatus on the day of surgery (POD 0). Overall, both groups showed a similar recovery pattern regarding bowel function.(table-5)

Table 5: First Passage of Flatus (Post-operative Day) among both groups

Post-operative Day (POD)	Group A	Group B	total
POD '0'	5	6	11
POD '1'	20	19	39
Total	25	25	50

POD – Post-operative Day

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Most patients in both groups were discharged within 3 days post-operatively — 24 (96%) in Group A and 21 (84%) in Group B. A small number of patients had a longer hospital stay of 5 days, more frequently observed in Group B. Overall, the mean hospital stay was comparable between the two groups, with the majority recovering within 3 days. (table 6)

Table 6: Length of Hospital Stay (in Days) among both groups

Length of Hospital Stay (Days)	Group A	Group B	Total
3 Days	24	21	45
5 Days	1	4	5
Total	25	25	50

Port-site infection occurred in 1 patient (4%) from Group A and 4 patients (16%) from Group B. Although the incidence was higher in Group B, the difference was not statistically significant ($p = 0.157$; $\alpha = 0.05$). Hence, there is no significant association between the type of group and occurrence of port-site infection.(table-7)

Table 7: Port-Site Infection among both groups

Port-Site Infection	Group A	Group B	total
Yes	1	4	5
No	24	21	45
Total	25	25	50

Chi-Square Test: $\chi^2(1) = 2.000$, $p = 0.157$ Significance level (α) = 0.05

DISCUSSION

Appendicitis continues to be one of the most frequent surgical emergencies worldwide, and laparoscopic appendectomy has become the preferred approach due to its minimally invasive nature, reduced postoperative pain, shorter hospital stay, and quicker recovery when compared to open surgery (Semm, 1983; Li et al., 2018)[13,14]. Despite its advantages, challenges remain in safely retrieving the inflamed appendix during laparoscopy. The present study compared two commonly used retrieval techniques—using a Plastic Endo-Bag and direct retrieval through a 10 mm umbilical port—to evaluate their influence on operative efficiency and postoperative outcomes.

In the present analysis, the mean operation time was slightly longer in the group where the Plastic Endo-Bag was employed compared to the direct retrieval group. This finding is consistent with the observations of Jeon et al. (2016)[15], who noted that operative time may increase due to additional procedural steps such as bag deployment and specimen encapsulation. Similarly, the specimen retrieval time was also found to be significantly higher—by nearly one minute—in the Endo-Bag group. These results are in agreement with studies by Beldi et al. (2004)[16] and Ramesh et al. (2019)[17], which reported marginally longer operative durations with retrieval bag use, though the differences were not clinically substantial. The slightly longer operative time is offset by the potential reduction in intra-abdominal contamination, particularly in complicated or perforated appendicitis cases.

Postoperative recovery parameters, including the first passage of flatus, showed no significant difference between the two groups, indicating that the method of specimen retrieval does not affect bowel function recovery. Similar findings were reported by Kazemier et al. (2006)[18], who demonstrated comparable postoperative recovery profiles between patients undergoing laparoscopic appendectomy with and without a retrieval bag. The mean length of hospital stay in this study was also consistent with published literature (Yau et al., 2013)[19], with most patients being discharged within three days and only those with port-site infections requiring extended hospitalization.

Port-site infections were slightly more common in the direct retrieval group; however, this difference did not reach statistical significance. Previous studies by Mayir et al. (2014)[20] and Beldi et al. (2004)[16] also found that retrieval bags may reduce the risk of wound contamination, though conclusive evidence remains limited. While the current study could not establish a statistically significant correlation, the use of an Endo-Bag theoretically reduces the risk of bacterial contamination and subsequent infection by containing infected material within the bag before extraction.

In conclusion, although the use of a Plastic Endo-Bag slightly prolongs operative and retrieval times, it may offer advantages in

minimizing contamination and infection risk. The findings of the present study align with existing evidence suggesting that retrieval bags enhance surgical safety in potentially contaminated laparoscopic procedures. However, due to the small sample size and single-center design, these results should be interpreted with caution. Future multicentric studies with larger populations, as suggested by Jeon et al. (2016)[15] and Yau et al. (2013)[19], are recommended to validate these findings and establish definitive clinical guidelines for optimal specimen retrieval techniques in laparoscopic appendectomy.

Limitations of the Study

1. The study involved a small sample size (n=50), which may limit the statistical power and generalizability of the findings.
2. It was a single-center study, potentially introducing selection bias.
3. Short follow-up duration limited assessment of late postoperative complications.
4. Other confounding factors such as surgeon experience, intraoperative difficulty, and patient comorbidities were not extensively analyzed.
5. The study did not include a cost-benefit analysis comparing the Plastic Endo-Bag and direct retrieval methods.

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