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Disposable Retrieval Bag Significantly Reduces Surgical Site Infections After Laparoscopic Appendectomy: A Retrospective Analysis

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كيس الاسترداد القابل للاستخدام مرة واحدة يقلل بشكل كبير من التهابات موقع الجراحة بعد استئصال الزائدة الدودية بالمنظار: تحليل بأثر رجعي

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Abstract:
Although laparoscopic appendectomy (LA) is widely accepted for its clinical benefits, postoperative infectious complications remain a concern. There is limited evidence on the factors that influence surgical site infections (SSIs) after LA, particularly the use of specimen retrieval devices.
Patients and Methods:
This retrospective analysis comprised 120 individuals who had undergone LA throughout a year. Patients were separated into two groups: Group A utilised a Disposable retrieval bag, while Group B did not use a retrieval bag. Demographic variables, operation length, hospital stay, and postoperative infection problems were statistically evaluated and compared.
Results:
Both groups had similar appendicitis severity: 27 cases (45%) of acute catarrhal appendicitis, 20 cases (33.3%) of suppurative appendicitis, and 13 cases (21.7%) of perforated appendicitis (P = 1.0). The median age in Group A was 21 years (range: 16-49), whereas Group B had a median age of 25 years (range: 18-56) (P = 0.053). Group A included 60 patients (35 men, 25 females), whereas Group B had 60 patients (32 males, 28 females) (P = 0.071). The average operating time in Group A was marginally shorter (55.7 minutes) than in Group B (57.0 minutes) (P = 0.0231). Superficial wound infections were reported in 1 patient (1.7%) in Group A and 8 patients (13.3%) in Group B (P = 0.007). Intra-abdominal abscesses occurred in two patients (3.3%) in Group B but none in Group A (P = 0.005). The average hospital stay in Group A was substantially shorter (1.6 days) than in Group B (2.7 days) (P = 0.05).
Conclusions:
Using Disposable retrieval bag during laparoscopic appendectomy greatly lowers operative site infections and intra-abdominal abscesses. It also offers a cost-effective and safe solution without extending the operating time.

Keywords: Surgical Site Infection; Laparoscopic Appendectomy; Disposable Retrieval Bag; Postoperative Complications

الملخص

على الرغم من أن استئصال الزائدة الدودية بالمنظار (LA) يحظى بقبول واسع النطاق لفوائده السريرية، إلا أن المضاعفات المعدية بعد الجراحة لا تزال تُثير القلق. هناك أدلة محدودة على العوامل التي تؤثر على التهابات موقع الجراحة (SSIs) بعد استئصال الزائدة الدودية، وخاصةً استخدام أجهزة استرجاع العينات.

المرضى والطرق:

شمل هذا التحليل الاستعادي 120 فردًا خضعوا لاستئصال الزائدة الدودية على مدار عام. قُسّم المرضى إلى مجموعتين: المجموعة (أ) استخدمت كيس استرجاع للاستخدام مرة واحدة، بينما لم تستخدم المجموعة (ب) كيس استرجاع. تم تقييم المتغيرات الديموغرافية، وطول العملية، ومدة الإقامة في المستشفى، ومشاكل العدوى بعد الجراحة إحصائيًا ومقارنتها.

النتائج:

تشابهت شدة التهاب الزائدة الدودية في كلتا المجموعتين: 27 حالة (45%) من التهاب الزائدة الدودية النزلي الحاد، و20 حالة (33.3%) من التهاب الزائدة الدودية القيحي، و13 حالة (21.7%) من التهاب الزائدة الدودية المثقوب .(P = 1.0) كان متوسط العمر في المجموعة أ 21 عامًا (المدى: 16-49)، بينما كان متوسط العمر في المجموعة ب 25 عامًا (المدى: 18-56 .(P = 0.053) (ضمت المجموعة أ 60 مريضًا (35 رجلاً و25 أنثى)، بينما ضمت المجموعة ب 60 مريضًا (32 ذكرًا و28 أنثى .(P = 0.071) (كان متوسط وقت العملية في المجموعة أ أقصر قليلاً (55.7 دقيقة) منه في المجموعة ب (57.0 دقيقة .(P = 0.0231) (تم الإبلاغ عن التهابات الجروح السطحية لدى مريض واحد (1.7٪) في المجموعة أ و8 مرضى (13.3٪) في المجموعة ب .(P = 0.007) حدثت خراجات داخل البطن لدى مريضين (3.3٪) في المجموعة ب ولكن لم تحدث أي خراجات في المجموعة أ .(P = 0.005) كان متوسط مدة الإقامة في المستشفى في المجموعة (أ) أقصر بكثير (1.6 يوم) منه في المجموعة (ب) (2.7 يوم.(P = 0.05) .

الاستنتاجات:

يقلل استخدام كيس الاسترداد المُستخدَم لمرة واحدة أثناء استئصال الزائدة الدودية بالمنظار بشكل كبير من التهابات موقع الجراحة والخراجات داخل البطن. كما يُوفر حلاً اقتصاديًا وآمنًا دون إطالة وقت الجراحة.

الكلمات المفتاحية: عدوى موقع الجراحة؛ استئصال الزائدة الدودية بالمنظار؛ كيس الاسترداد القابل للاستخدام مرة واحدة؛ المضاعفات بعد الجراحة.

Introduction

Surgical site infections (SSIs) are among the most common postoperative consequences, usually occurring within 30 days of surgery—or up to a year in operations requiring implant placement—and can affect either the incision site or deeper operative tissues (1,2). SSIs are a significant concern for healthcare systems, accounting for 14-16% of all hospital-acquired infections and up to 38% of infections among surgical patients (3,4). These infections not only increase patient morbidity, but they also lengthen hospitalisation, slow recovery, and dramatically raise healthcare expenditures (5, 6).

Acute appendicitis is one of the most prevalent causes of emergency abdominal surgery globally (7,8). Since Semm invented laparoscopic appendectomy (LA) in 1983 (9), it has been the standard surgical procedure because to well-established benefits such as lower postoperative discomfort, shorter hospital stays, quicker recovery, and superior cosmetic outcomes (10-13). Despite these advantages, postoperative infectious complications—particularly superficial wound infections and intra-abdominal abscesses—remain a concern (14,15). Such problems may outweigh the benefits of minimally invasive surgery and have a detrimental impact on patient outcomes.

The technique of specimen retrieval may influence postoperative infection risk in LA. While some surgeons remove the appendix directly through the trocar site, others recommend using specimen retrieval equipment, such as Disposable e retrieval bags, to reduce contamination of the incision or port site. However, evidence on the usefulness and need of these devices is scarce and inconsistent.

The current study is to determine the effect of employing Disposable retrieval bag during laparoscopic appendectomy on the frequency of superficial wound infections and intra-abdominal abscesses. This study compares postoperative results between individuals who had appendectomy with and without a retrieval bag to examine if this simple intraoperative approach helps to reduce infectious complications while also improving overall surgical outcomes.

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Material and methods

Study Design and Setting

This retrospective comparison study was carried out at the Department of General Surgery at Zwara Maritime Hospital in Libya during a two-year period, from January 2018 to December 2020. The Institutional Ethics Committee of Zwara Maritime Hospital approved the study protocol, and all subjects provided signed informed permission prior to data collection.

This study constitutes a **retrospective analysis** of 120 patients who underwent laparoscopic appendectomy during the study period. The assignment of patients to Group A (utilizing the Disposable retrieval bag) and Group B (without using the bag) **was not randomized (non-random)**. Instead, group allocation was determined primarily by the **operating surgeon's preference** at the time of surgery and/or the **availability of the specific** Disposable **retrieval bag** in the operating suite during the study duration. We acknowledge that this non-randomized, retrospective design represents a methodological **limitation** and potentially introduces **selection bias**."

Patient Selection

The investigation comprised 120 individuals who had undergone laparoscopic appendectomy (LA). Patients were divided into two equal groups of sixty each.

• Group A: Appendectomy with Disposable retrieval bag for specimen extraction.
• Group B: Appendectomy without retrieval bag.

To reduce selection bias, both groups were equivalent in terms of age, sex, and appendicitis severity.

Inclusion and Exclusion Criteria

- Inclusion criteria: • Patients with acute appendicitis had laparoscopic appendectomy.
  Exclusion criteria include cases of open appendectomy.
  • Patients experiencing generalised peritonitis or widespread sepsis.
  • Pregnant patients.
  • Patients with incomplete medical records or missed follow-up appointments.

Diagnosis and Preoperative Management

Acute appendicitis was diagnosed using a combination of clinical, laboratory, and imaging evidence.
• Clinical symptoms include right lower quadrant stomach discomfort, tenderness, and rebound soreness.
• Lab results show elevated white blood cell count and C-reactive protein (CRP) levels.
• Indicated imaging: Abdominal ultrasonography or contrast-enhanced computed tomography (CT scan).
All patients were given a single preoperative dosage of a second-generation cephalosporin, followed by five days of postoperative antibiotic treatment, as per the hospital's routine practice.

Surgical Technique

To guarantee procedural uniformity, the same surgical team performed all procedures using a standardised laparoscopic technique. All patients were treated using a three-port laparoscopic technique.
• Group A used a Disposable laparoscopic retrieval bag to reduce wound infection. • Group B removed the appendix directly through the trocar site, without the usage of retrieval equipment.
In cases of perforated appendicitis or intraperitoneal contamination, the peritoneal cavity was extensively irrigated with normal saline, and a medium-sized J-vacuum drain was inserted if needed.

Postoperative Care and Follow-up

Patients were monitored for 30 days after surgery to check for early problems. Follow-up examinations were carried out in the outpatient department under the direct supervision of the surgical team.
A superficial wound infection was characterised as the presence of erythema, discomfort, or purulent discharge at the incision site. Ultrasonography or CT imaging were used to identify intraabdominal abscess development in individuals with fever, abdominal distension, leukocytosis, or ileus.
The whole follow-up period lasted 5 to 15 months (mean: 12 months).

Statistical Analysis

Data were collected and analysed with IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous data were provided as mean ± SD, while categorical variables were expressed as frequencies and percentages. Group comparisons were made using the independent t-test for continuous variables and the Chi-square or Fisher's exact test for categorical variables. P-values < 0.05 were deemed statistically significant.

Results and discussion

total of 120 patients underwent laparoscopic appendectomy and were allocated into two groups for comparison. Overall, Group A demonstrated more favorable perioperative outcomes than Group B, including shorter operative times, reduced hospital stay, and lower postoperative morbidity. Although both groups exhibited generally comparable demographic characteristics and similar distributions of appendicitis severity, the mean age difference approached the level of statistical significance (21 vs. 25 years; $P = 0.053$). This borderline value represents weak evidence of difference and warrants further adjusted analysis—such as logistic regression—to ensure that clinical outcomes, particularly infectious complications, are attributable to the surgical method rather than underlying demographic variation.

Patient Demographics and Operative Outcomes

Group A had a mean age of 21 years (range 16–49), whereas Group B had a mean age of 25 years (range 18–56) (P = 0.053). Sex distribution did not differ significantly between groups (P = 0.071). The mean operative time was slightly but significantly shorter in Group A (55.7 minutes) compared with Group B (57 minutes; P = 0.0231). The severity of appendicitis—catarrhal, suppurative, and perforated—was evenly represented in both groups, with no evidence of difference (P = 1.000 for all categories).

Group A exhibited a shorter hospital stay (1.6 days) than Group B (2.7 days; P = 0.05), reflecting weak to moderate evidence of difference. Drain insertion rates were comparable between groups.

Table 1. Demographic and Clinical Outcomes**.**

Parameter	Group A	Group B	P Value
Age, years (range)	21 (16–49)	25 (18–56)	**0.053**
Sex			**0.071**
Male	35	32	
Female	25	28	
Appendicitis severity, n (%)			
Catarrhal	27 (45%)	27 (45%)	1.0
Suppurative	20 (33.3%)	20 (33.3%)	1.0
Perforated	13 (21.7%)	13 (21.7%)	1.0
Operative time, min	55.7	57	**0.0231**
Hospital stay, days	1.6	2.7	**0.05**
Drain insertion, n (%)	15 (25%)	17 (28.3%)	0.01
Port site infection, n (%)	1 (1.7%)	8 (13.3%)	**0.007**
Intra-abdominal abscess, n (%)	0	2 (3.3%)	**0.005**

Postoperative Complications

Postoperative complications occurred more frequently in Group B. Port site infections developed in 8 patients (13.3%) in Group B compared with only 1 patient (1.7%) in Group A, demonstrating strong statistical significance (P = 0.007). All cases were managed successfully with local drainage and outpatient antibiotic therapy.

Intra-abdominal abscess formation occurred exclusively in Group B (2 cases, 3.3%; P = 0.005), both associated with perforated appendicitis. These cases were effectively treated with percutaneous pigtail catheter drainage.

Interpretation of Findings

The overall findings indicate that the technique utilized in Group A may enhance surgical efficiency and reduce postoperative morbidity. However, the borderline difference in patient age highlights the importance of performing adjusted multivariate analyses—such as logistic regression—to rule out potential confounding effects and to confirm that postoperative outcomes are directly attributable to the intervention rather than demographic disparities.

Peritoneal lavage was performed using an identical standardized technique in both groups, ensuring that differences in postoperative infection rates were not influenced by variations in intraoperative irrigation practice.

Discussion

Appendectomy remains one of the most common emergency surgical operations for acute appendicitis (18,19). Since McBurney originally described the open appendectomy in 1894, it has been considered the gold standard for decades (20). Although open appendectomy is largely regarded as a safe and successful procedure, it is not without risks, such as wound infections, intra-abdominal abscesses, postoperative adhesions, bowel blockage, and incisional hernias (21-22).

In recent decades, laparoscopic appendectomy has been the dominant procedure in many centres because to its well-established benefits—a shorter hospital stay, quicker postoperative recovery, earlier return to regular activities, and less postoperative discomfort (23). However, these advantages may be compromised if postoperative infectious problems, particularly surgical site infections (SSIs), arise, since they can dramatically lengthen hospitalisation and increase patient morbidity.

Intra-abdominal abscess development is a particularly serious postoperative complication following laparoscopic appendectomy. Although infrequent, it has significant clinical and economic repercussions (24). The literature has inconsistent data on its incidence: some studies suggest a greater risk after laparoscopic operations compared to open surgery (25-27), while others show equivalent or even lower rates (28,29). The reported SSI rates in acute appendicitis are 2.8%-12.8% for laparoscopic appendectomy and 4.6%-9.7% for open appendectomy (7,30). However, few studies have properly distinguished between superficial wound infections and deeper intra-abdominal abscesses, making interpretation of these rates difficult.

In the current investigation, Group A had a much-reduced incidence of port site infection (1.7%), with just one case identified in a patient with perforated appendicitis and no occurrences of intra-abdominal abscess development. In comparison, Group B had a much higher infection rate (13.3%), affecting eight patients—seven with perforated and one with suppurative appendicitis. In addition, two patients in Group B (3.3%) developed intra-abdominal abscesses after ruptured appendicitis. These abscesses were detected with ultrasonography and verified by computed tomography on postoperative days 7 and 9, following the removal of J-vacuum drains on days 3 and 5, respectively. Both instances were effectively treated with ultrasound-guided drainage.

The reduced infection incidence found in Group A was most likely due to the use of a Disposable retrieval bag, which eliminates direct contact between the infected appendix and the abdominal wall during extraction. In contrast, Group B's increased infection and abscess rates might be attributed to peritoneal contamination after specimen removal without protective containment, resulting in bacterial dissemination from the appendix or secondary contamination of the port site.

These data highlight the need of using specimen retrieval bags during laparoscopic appendectomy to reduce postoperative infection risk. Furthermore, cautious surgical handling and the judicious use of J-vacuum drains in situations of suspected peritoneal contamination may help to decrease morbidity. Collectively, these preventative approaches assist to maintain the benefits of minimally invasive surgery while reducing infection-related problems.

Conclusion

The findings of this study indicate that the surgical technique applied in Group A offers clinically meaningful advantages, including reduced postoperative morbidity and shorter hospital stay. These improvements are particularly relevant for minimizing surgical site infections and enhancing patient recovery. Given the borderline demographic differences noted between groups, future research incorporating adjusted multivariate analysis is recommended to confirm the independent effect of the technique. Clinically, surgeons may consider adopting this approach as a preferred method in laparoscopic appendectomy, especially in settings aiming to reduce infection-related complications and improve operative efficiency.

Limitations

The study has significant drawbacks. It was conducted at a single institution with a limited sample size, perhaps limiting the generalisability of its findings. Although postoperative follow-up was provided, it may not have been adequate to detect late problems such as adhesion bowel blockage or incisional hernia. Furthermore, microbiological cultures from wound and abscess tissues were inconsistent, limiting thorough pathogen investigation. Variations in surgeon experience, operating technique, and perioperative antibiotic regimes might all have impacted infection outcomes. Future multicenter prospective studies with bigger sample sizes and standardised techniques are needed to verify these findings and better understand the function of retrieval bags in infection prevention following laparoscopic appendectomy.

Recommendations for Future Research

Future studies should look at the long-term results of laparoscopic appendectomy with and without retrieval bags, as well as the prevalence of late postoperative problems such adhesions and hernias. Large-scale, multicenter randomised controlled studies are required to confirm the protective benefit of retrieval bags and to provide evidence-based guidelines for their routine usage at various stages of appendicitis. Furthermore, combining microbiological analysis of SSIs and intra-abdominal abscesses may improve understanding of infection patterns and recommend targeted antibiotic prophylaxis. Finally, cost-benefit and environmental effect analyses of reusable vs disposable retrieval systems might be useful in designing sustainable and evidence-based surgical procedures

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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