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Original article

Early *versus* Interval Laparoscopic Appendectomy for Appendicular Abscess: A Prospective Randomized Comparative Study

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Abstract
The optimal timing for laparoscopic surgery in patients presenting with an appendicular abscess remains controversial. Management strategies include immediate laparoscopic drainage and appendectomy versus initial conservative treatment with antibiotics, with or without percutaneous drainage (PCD), followed by delayed interval appendectomy. This study aimed to compare early versus delayed laparoscopic intervention in terms of technical difficulty, safety, and postoperative outcomes. This prospective randomized trial included 50 patients diagnosed with appendicular abscess, equally allocated into two groups: the Early Laparoscopic Group (ELG, n=25), who underwent immediate laparoscopic drainage and appendectomy, and the Delayed Laparoscopic Group (DLG, n=25), who received initial conservative management followed by interval laparoscopic appendectomy after 6–8 weeks. The primary outcome was postoperative complications, including fecal fistula and intra-abdominal collections. Secondary outcomes included operative time (min), hospital stay, conversion rate, and overall treatment success. Baseline demographic, clinical, and radiological characteristics were comparable between the groups. The mean operative time was significantly longer in the ELG (105.4 ± 18.7 min) compared to the DLG (68.2 ± 15.3 min; P<0.001). Conversion to open surgery occurred more frequently in the ELG (16%) compared to the DLG (4%), although this difference was not statistically significant (P=0.35). The total hospital stays over the entire treatment period showed a trend toward being shorter in the ELG (6.1 ± 2.1 days) compared to the DLG (8.5 ± 3.4 days), although this did not reach statistical significance (P=0.06). Postoperative fecal fistula occurred in 2 patients (8%) in the ELG and in none of the patients in the DLG (P=0.49). During the waiting period, 2 patients (8%) in the DLG developed recurrent collections, both managed conservatively, while no postoperative collections were observed in the ELG. Additionally, 4 patients (16%) in the DLG required readmission or unplanned intervention prior to scheduled surgery. Both early and delayed laparoscopic approaches are viable options for managing appendicular abscess. Early intervention offers a single-stage treatment and eliminates the risk of recurrence during the waiting period, but is associated with longer operative time and a tendency toward higher postoperative morbidity. Delayed laparoscopic appendectomy is technically less demanding but requires an initial conservative phase, with a risk of treatment failure and the need for multiple hospital admissions. Careful patient selection and shared decision-making remain essential.
Keywords. *Appendicular Abscess, Laparoscopy, Early Appendectomy, Interval Appendectomy, Complicated Appendicitis.*

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Introduction

Appendicular abscess, a severe complication of perforated appendicitis, occurs in 2% to 10% of cases and presents a significant clinical challenge [1]. The traditional management paradigm for an appendicular abscess has shifted from immediate surgery, which was associated with high morbidity, towards a more conservative approach. This typically involves initial treatment with broad-spectrum antibiotics and, in many cases, image-guided percutaneous drainage, followed by an elective interval appendectomy after 6-10 weeks [2, 3]. This strategy aims to convert a difficult, inflamed surgical field into a more favorable one, potentially reducing the risk of complications like bowel injury and the need for ileocecal resection [4]. However, this conservative approach is not without its drawbacks. It requires a prolonged course of antibiotics, repeated imaging, and a second hospital admission for the definitive surgery. Furthermore, a significant proportion of patients (10-20%) may fail conservative management, requiring an urgent intervention during the waiting period due to recurrence or progression of symptoms [5].

The development of interval appendectomy also means the patient must endure the initial symptoms and a subsequent operation. With advancements in laparoscopic surgery and perioperative care, some centers have revisited the concept of early laparoscopic intervention for appendicular abscess. Proponents argue that a single, definitive procedure performed by an experienced surgeon can be safe and effective, eliminating the need for a two-stage approach and its associated inconveniences and risks [6, 7]. Despite advances in laparoscopic techniques, the optimal timing of surgical intervention for appendicular abscess remains controversial. Some surgeons advocate early laparoscopic appendectomy to avoid recurrence and repeated

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hospital admissions, whereas others support initial conservative management followed by interval appendectomy to reduce operative difficulty and complications. Therefore, this prospective randomized study aimed to compare the outcomes of early versus delayed laparoscopic intervention for appendicular abscess in terms of operative difficulty, postoperative complications, hospital stay, and overall treatment success.

Methods

Study Design and Setting

This prospective randomized controlled study was conducted at the Emergency and General Surgery at Tobruk Medical Center from January 2025 to December 2025. Eligible participants were patients aged between 18 and 65 years, diagnosed with an appendicular abscess based on clinical examination and contrast-enhanced computed tomography (CT) findings (a well-defined, walled-off collection in the right iliac fossa or pelvis with evidence of appendiceal inflammation). Patients were excluded if they were under 18 or over 65 years of age, presented with septic shock or generalized peritonitis, had an appendicular phlegmon without a drainable collection, had an ASA physical status > III, were pregnant, or had a history of major abdominal surgery. Sample Size and Randomization. Based on previous literature reporting a complication rate of 30% for early surgery and 10% for interval surgery [7], a sample size of 25 patients per group was calculated to detect a 20% difference with 80% power and a 95% confidence interval, using OpenEpi software. Patients were randomly assigned in a 1:1 ratio to either the Early Laparoscopic Group (ELG) or the Delayed Laparoscopic Group (DLG) using a computer-generated random number sequence.

Interventions

Early Laparoscopic Group (ELG): Patients underwent laparoscopic drainage of the abscess and appendectomy within 24 hours of diagnosis. The procedure was performed under general anesthesia using a standard three-port technique (supraumbilical, suprapubic, and left iliac fossa). Adhesiolysis was performed to access the abscess cavity. Pus was evacuated and sent for culture. The appendix was identified, and its base was managed according to the degree of inflammation (using endoloops, clips, or sutures). Copious irrigation with warm saline was performed, and a pelvic drain was placed. Delayed Laparoscopic Group (DLG): Patients were initially managed conservatively with intravenous broad-spectrum antibiotics (e.g., ertapenem or piperacillin-tazobactam) and, if the abscess was >4cm and accessible, ultrasound-guided percutaneous drainage using the Seldinger technique. Patients were discharged once clinically improved, afebrile, and tolerating a normal diet, with a course of oral antibiotics. They were scheduled for an elective interval laparoscopic appendectomy 6-8 weeks later. During the waiting period, patients were followed up in the outpatient clinic.

Follow-up and Outcomes

All patients were followed for three months after their final procedure (appendectomy). The primary outcome was the rate of postoperative complications, specifically fecal fistula and intra-abdominal collections. Secondary outcomes included operative time for the appendectomy, conversion rate to open surgery, total hospital stay (including the initial admission and readmission for surgery in the DLG), failure of conservative management (in DLG), and quality of life at 3 months (assessed using a simple Likert scale: excellent, good, fair, poor).

Statistical Analysis

Data were analyzed using SPSS version 25. Categorical variables were presented as frequencies and percentages and compared using the Chi-square or Fisher's exact test. Continuous variables were presented as mean ± standard deviation and compared using the independent samples t-test or Mann-Whitney U test. A p-value of <0.05 was considered statistically significant.

Results

A total of 50 patients were enrolled, with 25 in each group. The two groups were well-matched in terms of age, sex, BMI, and comorbidities (P > 0.05 for all). The mean age was 32.4 ± 10.1 years in the ELG and 34.1 ± 9.5 years in the DLG. Clinical presentation and baseline radiological findings, including abscess size (ELG: 6.1 ± 1.9 cm vs. DLG: 5.8 ± 1.7 cm, P=0.56), were also comparable between groups.

Table 1. Baseline Abscess Characteristics

Parameter	ELG (n=25)	DLG (n=25)	P-value
Abscess Size on CT (cm)	6.1 ± 1.9	5.8 ± 1.7	0.56
Abscess Location (RIF/Pelvic)	20 / 5	18 / 7	0.51
Multiple Loculations (n, %)	4 (16%)	3 (12%)	1.00

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Management and Operative Outcomes

In the DLG, 4 patients (16%) required percutaneous drainage during the initial conservative management. All patients in this group were successfully discharged. However, during the 6-8 week waiting period, 4 patients (16%) experienced a recurrence of symptoms requiring readmission: two were managed conservatively with antibiotics, and two required an emergency laparoscopic drainage and appendectomy before their scheduled date (these were analyzed on an intention-to-treat basis). The mean operative time for the appendectomy was significantly longer in the ELG (105.4 ± 18.7 min) compared to the DLG (68.2 ± 15.3 min, P<0.001). Conversion to open surgery was required in 4 patients (16%) in the ELG due to a severely inflamed, friable cecal base, compared to 1 patient (4%) in the DLG (P=0.35). The need for more complex stump management (sutures or omental patch) was higher in the ELG (32% vs. 12%, P=0.09).

Table 2. Operative and Perioperative Data

Parameter	ELG (n=25)	DLG (n=25)	P-value
Management of DLG			
- Successful conservative management	-	21 (84%)	-
- Required PCD during initial stay	-	4 (16%)	-
- Failure/Recurrence before the interval app.	-	4 (16%)	-
Operative Data (Appendectomy)			
- Mean Operative Time (min)	105.4 ± 18.7	68.2 ± 15.3	<0.001
- Conversion to Open Surgery	4 (16%)	1 (4%)	0.35
- Complex Stump Management	8 (32%)	3 (12%)	0.09

Primary and Secondary Outcomes

Postoperative fecal fistula occurred in 2 patients (8%) in the ELG. Both were managed conservatively with total parenteral nutrition and bowel rest, closing spontaneously within 10-14 days. No fistulas occurred in the DLG (P=0.49). Postoperative intra-abdominal collections were seen in 1 patient (4%) in each group, both of whom were managed successfully with percutaneous drainage. The total hospital stay over the entire treatment period was not significantly different between the groups (ELG: 6.1 ± 2.1 days vs. DLG: 8.5 ± 3.4 days, P=0.06). The total cost of treatment was calculated to be lower in the ELG (P<0.001) as it involved a single admission. At the 3-month follow-up, the quality of life was rated as "excellent" or "good" by 84% of patients in the ELG and 92% in the DLG (P=0.67).

Table 3. Primary and Secondary Outcomes

Parameter	ELG (n=25)	DLG (n=25)	P-value
Primary Outcome			
- Postoperative Fecal Fistula	2 (8%)	0 (0%)	0.49
- Postoperative Collection	1 (4%)	1 (4%)	1.00
Secondary Outcomes			
- Total Hospital Stay (days)	6.1 ± 2.1	8.5 ± 3.4	0.06
- Total Treatment Cost	4,850 ± 920	6,320 ± 1,150	<0.001
- Excellent/Good QoL at 3 months	21 (84%)	23 (92%)	0.67

Discussion

The management of appendicular abscess continues to evolve, and the optimal timing for surgical intervention remains a point of clinical debate. This prospective randomized study compared early laparoscopic appendectomy with a delayed approach following initial conservative management. Our findings indicate that while early intervention provides a definitive one-stage treatment, it is associated with greater technical difficulty, as evidenced by significantly longer operative times and a trend towards higher conversion rates and postoperative morbidity. Conversely, a delayed approach, though technically easier, carries a risk of failure during the waiting period and requires a longer overall treatment trajectory. Our results align with the historical concerns regarding immediate surgery for complicated appendicitis. The significantly longer operative time and higher conversion rate in the ELG (16%) reflect the technical challenges posed by acute inflammation, friable tissues, and distorted anatomy. This is consistent with studies by Antonacci et al. [8] and Wagner et al. [9], which identified the presence of an abscess as a strong predictor of conversion from laparoscopic to open appendectomy. The need for complex stump management in nearly one-third of our ELG patients underscores the severity of the local inflammatory process. The 8% incidence of postoperative fecal fistula in the ELG, while not statistically significant due to the sample size, is a clinically important finding. This rate is higher than that reported in some series for interval

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appendectomy [10] but comparable to other studies reporting on immediate surgery for appendicular mass [11].

It highlights the potential danger of attempting to dissect and ligate an appendix in a severely inflamed environment, where the base may be extremely friable or partially necrotic. The conservative management of these fistulas was successful in our series, but they represent a significant source of morbidity. On the other hand, the delayed approach was not without its problems. The 16% failure rate during the waiting period, necessitating readmission or unplanned intervention, mirrors the findings of Mentula et al. [5] and others, who reported failure rates of 10-30% for non-operative management of appendicular abscess. This means that for a subset of patients, the delayed approach results in two admissions and an emergent rather than an elective procedure, negating the intended benefits.

The total hospital stays, when accounting for both the initial and subsequent admissions in the DLG, was not significantly different from the single stay in the ELG. This finding challenges the notion that a delayed approach is significantly more resource-intensive in terms of hospital days, though the total cost was higher due to two separate admissions, as also noted by Fagenholz et al. [12]. The similar quality of life outcomes at three months suggests that both strategies ultimately lead to a good recovery, provided complications are managed effectively.

Conclusion

Both early and delayed laparoscopic strategies are effective options for the management of appendicular abscess. Early laparoscopic intervention offers a single-stage treatment but is associated with greater operative difficulty and a higher risk of complications. In contrast, delayed laparoscopic appendectomy following conservative management is technically easier but carries a risk of recurrence during the waiting period. Individualized patient selection and surgeon experience remain key factors in determining the optimal treatment strategy.

Conflict of interest. Nil

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