Original Article

A Study of Comparison of Post-operative Pain in Open and Laparoscopic Appendectomy

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Author`s Contribution

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ABSTRACT

Objectives: To compare post-operative pain, analgesic requirements, complications, hospital stay, and recovery outcomes between laparoscopic and open appendectomy.

Methodology: This prospective observational study was conducted in the Department of General Surgery, Islamabad Medical Complex, NESCOM, from April to September 2024. A total of 60 patients with acute appendicitis were enrolled, with 30 each undergoing LA or OA. All patients during data collection period undergoing appendectomy were included in the study. Patients unfit for laparoscopic intervention as patients with cardiac or pulmonary disease, patients who were treated conservatively beyond 24 hours of admission and patients on chronic pain medication for any other issues were excluded.All patients received intravenous paracetamol (1 g thrice in 24 hours) and ketorolac tromethamine (30 mg twice in 24 hours). Post-operative pain was assessed using the Visual Analogue Scale (VAS) at 4 hours, 24 hours, and 14 days. Outcomes included analgesic use, hospital stay, return to normal activity, and complications. Data were analyzed using SPSS 25.0, with $p \leq 0.05$ considered significant.

Results: LA patients had significantly lower pain scores at 4 hours (4.93 vs. 6.13, p=0.029) and 24 hours (3.20 vs. 4.40, p=0.021). Additional analgesic use was significantly less in LA (p=0.013). Hospital stay was similar, but return to normal activity was faster with LA (2.87 vs. 3.60 weeks, p<0.001). Wound infection was higher in OA (13.3% vs. 0%, p=0.038).

Conclusion: Laparoscopic appendectomy results in lower post-operative pain, fewer complications, and earlier recovery compared with open appendectomy, supporting LA as the preferred approach for acute appendicitis.

Keywords: Appendicitis; Laparoscopic appendectomy; Open appendectomy; Post-operative pain; Surgical outcomes.

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Introduction

Acute appendicitis is one of the most common abdominal surgical emergencies, with a lifetime risk estimated at 7–8%. It is particularly prevalent among young adults but can occur at any age, making it a significant contributor to emergency surgical admissions worldwide. Appendectomy, whether performed by the open or laparoscopic approach, remains the treatment of choice. For several decades, open appendectomy (OA) was considered the gold standard because of its established safety, effectiveness, and relative technical simplicity. However, the introduction of laparoscopic appendectomy (LA) has revolutionized the management of acute appendicitis, offering several clinical and cosmetic advantages.[1]

Laparoscopic appendectomy has the advantage of smaller incisions, shorter recovery time, shorter length of stay, faster recovery to daily activities, and more favorable cosmesis than open. It is also associated with less post-operative pain and as a result less analgesic consumption, a critical factor affecting patient satisfaction and early mobilization.[1] Another important benefit of laparoscopy is its capacity to visualize the whole peritoneal cavity and

therefore to diagnose other intra-abdominal pathologies that may have symptoms which can mimic those of appendicitis (diverticulitis, gynecological disorders or mesenteric adenitis). Although all these advantages have been identified, there are drawbacks that limit its practical application everywhere, such as the fact that laparoscopic equipment is rather expensive and requires highly trained surgical personnel and proper facilities.[2]

The relative advantages and disadvantages of LA and OA remain a subject of controversy between surgeons. Laparoscopic appendectomy has shown better results in the cases of uncomplicated appendicitis and is now universally considered as the method of choice in this procedure.[3] At the beginning, open appendectomy remained a method of choice in complicated appendicitis, including cases of perforation or abscess, because of concerns about intra-abdominal sepsis and technical challenges with laparoscopy. Recently, there has been a rebuttal in the consensus that LA is unsafe in complicated appendicitis, and several systematic reviews and meta-analyses have reported reductions in wound infections and faster recovery duration, with comparable rates of complications when compared with OA.[4–6]

Post-operative pain is one of the most important considerations in evaluating surgical outcomes. Inadequately controlled pain not only reduces patient comfort but can also impair pulmonary function, delay mobilization, prolong hospitalization, and negatively impact overall recovery. The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue injury. Post-operative pain is acute in nature and results from tissue damage, inflammation, and activation of afferent neurons during surgery. Pain assessment in clinical practice is often performed using the Visual Analogue Scale (VAS), which is a reliable, reproducible, and widely accepted tool in both clinical and research settings.[1] Effective pain management is essential, as poorly controlled post-operative pain can increase the risk of complications, suppress immune responses, and negatively influence wound healing.

Besides pain there are other outcome measures which include post-operative analgesic requirements, hospital stay, complications and time to normal activity of daily life that are equally vital in comparing the relative efficacy of laparoscopic and open appendectomy. Different international researches have assessed these consequences with different findings. Although a majority of them indicate that laparoscopic appendectomy is the best in references to post operative pain, wound infection and the duration of recovery, some few report some demerits such as longer duration of operation and it is uneconomical in cost.[2,3,7] Consequently, the preference of the surgical technique tends to vary depending on the expertise of the surgeons and other available resources at the time. Surgeon experience and other factors specific to a patient influence the various decisions made regarding the procedure.

The question of OA versus LA is especially pertinent to Pakistan and other developing nations, where the healthcare resources are not necessarily abundant. Though laparoscopic appendectomy is now being done more frequently, OA is more prevalent because it is simple, affordable, and performed even in some resource-poor countries. This highlights the need of local research to assess outcomes in our population, where other factors, such as patient demographics and disease presentation, and our differences in healthcare infrastructure could affect results.

This study was conceived to analyze the differences between laparoscopic and open appendectomy with the specific interests on post-operative pain at 4, 24 and 14 days after surgery. Secondary endpoints were the need to receive another analgesic dosage, presence of complications, number of days spent in hospital, and time needed to recover. Carefully analysing these parameters systematically, the study will add some evidence to the current debate concerning which surgical procedure is best when treating the acute appendix in our local environment.

Methodology

It is a prospective observational comparative study of six months (April- September, 2024) in the Department of General Surgery in Islamabad Medical Complex, NESCOM. A total of 60 patients with acute appendicitis determined and planned to undergo operating surgery were recruited. The study was approved by the Hospital Ethical Approval Committee of Islamabad Medical Complex and written informed consent was obtained prior to enrolment of all subjects.

The sample size of 60 patients, with 30 undergoing laparoscopic appendectomy and 30 undergoing open appendectomy, was calculated using the WHO sample size calculator with reference to a previously published study. All patients during data collection period

undergoing appendectomy were included in the study. Patients unfit for laparoscopic intervention as patients with cardiac or pulmonary disease, patients who were treated conservatively beyond 24 hours of admission and patients on chronic pain medication for any other issues were excluded.

All operations were performed by consultant surgeons or under their direct supervision. Laparoscopic appendectomy was performed using the standard three-port technique, whereas open appendectomy was carried out via the right lower quadrant (McBurney's) incision. Drain placement was done only if deemed necessary by the operating surgeon based on intraoperative findings. All patients received a standardized analgesic regimen consisting of intravenous paracetamol (1 g, three times in 24 hours) and intravenous ketorolac tromethamine (30 mg, twice in 24 hours). Post-operative pain was assessed using the Visual Analogue Scale (VAS) at 4 hours, 24 hours, and 14 days after surgery, and any additional requirement of analgesics beyond the standard protocol was documented.

Other outcome measures included the number of additional doses of analgesics required, the length of hospital stay, the time to return to normal daily activities, and the occurrence of post-operative complications such as fever, wound infection, abdominal abscess, and ileus. Demographic data, history of previous abdominal surgery, and previous appendicitis attacks were also recorded using a structured proforma.

Data were entered and analyzed using SPSS version 25.0. Continuous variables such as age, operative time, VAS scores, hospital stay, and time to return to normal activity were expressed as mean ± standard deviation (SD) and compared using the Student's t-test. Categorical variables including gender distribution, drain placement, and post-operative complications were expressed as frequencies and percentages and analyzed using the Chi-square test or Fisher's exact test as appropriate. A p-value ≤0.05 was considered statistically significant.

Results

A total of 60 patients were included in the study, with 30 undergoing laparoscopic appendectomy and 30 undergoing open appendectomy. The baseline characteristics of both groups are presented in Table 1. The mean age was higher in the laparoscopic group (31.73 ± 12.81 years) compared to the open group (22.13 ± 13.31 years). Gender distribution was comparable, with a slight male predominance in both groups. Previous history of abdominal surgery and previous appendicitis attacks was similar between the two groups, with no statistically significant differences.

Table I: Patient Demographics and Baseline Characteristics (n=60)

Characteristic	Category	Laparoscopic (n=30)	Open (n=30)
Age (years)	Mean ± SD	31.73 ± 12.81	22.13 ± 13.31
Gender	Male	16 (53.3%)	18 (60.0%)
	Female	14 (46.7%)	12 (40.0%)
Previous Abdominal Surgery	Yes	2 (6.7%)	4 (13.3%)
	No	28 (93.33%)	26 (86.67%)
Previous Appendicitis Attacks	Yes	2 (6.7%)	2 (6.7%)
	No	28 (93.33%)	28 (93.33%)

Operative details and post-operative pain scores are shown in Table 2. The mean operative time was slightly longer in the laparoscopic group (46.67 minutes) compared to the open group (44.67 minutes), but the difference was not statistically significant (p=0.707). Drain placement was more frequent in the laparoscopic group (13.3%), which was statistically significant (p=0.038). Post-operative pain assessment using the

Table II: Comparison of Operative Details and Post-Operative Pain Score (n=60)

Variable	Appendectomy	N	Mean	Std. Deviation	P-value
Operative Time (min)	Laparoscopic	30	46.67	25.023	0.707
	Open	30	44.67	14.559	
Drain Placement	Laparoscopic	30	4 (13.3%)		0.038*
	Open	30	0 (0.0%)		
Post-operative pain					
VAS at 04 hours	Laparoscopic	30	4.93	2.149	0.029*
	Open	30	6.13	1.995	
VAS at 24 hours	Laparoscopic	30	3.2	2.074	0.021*
	Open	30	4.4	1.85	
VAS at 14 days	Laparoscopic	30	1.47	0.819	0.07*
	Open	30	1.8	0.551	

Table III: Post-Operative Recovery and Complications (n=60)

Outcome Measure	Laparoscopic (n=30)	Open (n=30)	p-value
Number of times post-operative analgesic required other than the standard			
One Time	4(13.3%)	6 (20.0%)	0.013*
Two Times	0 (0%)	6 (20.0%)	
Three Times	0 (0%)	2 (6.7%)	
Nil	26 (86.7%)	16 (53.3%)	
Hospital Stay (days) Mean ± SD	1.87 ± 1.042	2.0 ± 0.543	0.553
Time to Normal Routine (weeks) Mean ± SD	2.87 ± 0.819	3.60 ± 0.621	0.000*

Visual Analogue Scale (VAS) revealed significantly lower scores in the laparoscopic group at 4 hours (4.93 vs. 6.13, p=0.029) and 24 hours (3.2 vs. 4.4, p=0.021). At 14 days, the laparoscopic group continued to report lower pain scores (1.47 vs. 1.8), though the difference was not statistically significant (p=0.07).

Post-operative recovery and analgesic requirements are summarized in Table 3. The requirement for additional analgesia beyond the standard protocol was significantly lower in the laparoscopic group (p=0.013), with 86.7% of patients requiring none compared to 53.3% in the open group. The mean hospital stay (1.87 ± 1.042 vs. 2.0 ± 0.543 days, p=0.553) did not differ significantly between the two groups. However, patients in the laparoscopic group resumed normal routine activities significantly earlier than those in the open group (2.87 ± 0.819 vs. 3.60 ± 0.621 weeks, p<0.001).

Table 4: Comparison of Post-Operative Complications

Complication	Status	Laparoscopic (n=30)	Open (n=30)	P-value
Fever	No	28	24	0.129
	Yes	2	6	
Wound Infection	No	30	26	0.038*
	Yes	0	4	
Abdominal Abscess	No	30	30	1.00
	Yes	0	0	
Ileus	No	28	30	0.150
	Yes	2	0	
Total		**30**	**30**	

A comparison of post-operative complications is provided in Table 4. Fever was observed more frequently in the open group (20%) compared to the laparoscopic group (6.7%), though this difference was not statistically significant (p=0.129). Wound infection occurred significantly more often in the open group (13.3%) compared to none in the laparoscopic group (p=0.038). No abdominal abscess was reported in either group. Ileus was noted in 6.7% of patients in the laparoscopic group but was absent in the open group (p=0.150).

Discussion

This study compared laparoscopic appendectomy (LA) and open appendectomy (OA) in terms of post-operative pain, analgesic requirement, complications, and recovery outcomes. The findings demonstrate that LA was associated with significantly lower early post-operative pain scores, reduced need for additional analgesia, quicker return to normal activities, and fewer wound infections compared with OA. These results support the growing evidence favoring laparoscopic techniques in the surgical management of acute appendicitis.

Pain outcomes in our study clearly showed the superiority of LA in the early post-operative period. Patients in the laparoscopic group reported significantly lower Visual Analogue Scale (VAS) scores at 4 and 24 hours post-operatively compared to the open group, while by day 14, pain levels were comparable. Similar findings were reported by Elsa, who observed lower post-operative pain and reduced analgesic requirements following LA [1]. Meta-analyses have also confirmed that LA is associated with improved pain control in the immediate post-operative period, though long-term differences become negligible.[8,9] These results suggest that laparoscopy provides an early advantage that translates into greater patient comfort and faster mobilization.

Our findings also revealed that most LA patients did not require additional analgesia beyond the standard regimen, whereas nearly half of OA patients required supplementary doses. This observation is consistent with studies by Ali[3] and Basukala S[7], which demonstrated significantly reduced analgesic use following LA. Decreased analgesic requirements not only improve patient satisfaction but also minimize the risks associated with excessive analgesic use, such as gastrointestinal upset and renal dysfunction.[10]

In terms of recovery, patients in the LA group resumed routine activities significantly earlier than those in the OA group. Faster convalescence after LA has been consistently documented in international studies.[11,12] This advantage may be attributed to reduced tissue trauma, smaller incisions, and less post-operative discomfort, all of which facilitate earlier ambulation and return to work. Interestingly, the mean duration of hospital stay in our study did not differ significantly between the two groups,

which is in line with some reports.[13] However, other studies have noted shorter hospital stays after LA, particularly in centers with greater laparoscopic experience.[14] Institutional protocols and discharge criteria likely influence this outcome.

With respect to complications, wound infection was significantly more frequent in OA, while none were observed in the laparoscopic group. This finding corroborates the results of earlier meta-analyses that consistently show lower wound infection rates with LA.[9,15] The reduced infection risk is attributable to smaller incisions and minimal tissue handling. Fever was also more common in the OA group, though not statistically significant. Interestingly, two cases of ileus occurred in the LA group. While ileus is not uncommon after laparoscopy, it is usually transient and self-limiting.[16] Importantly, no cases of intra-abdominal abscess were reported in either group, despite some literature suggesting a slightly higher risk of this complication following LA, particularly in complicated appendicitis.[17]

Operative time was marginally longer in LA, though the difference was not statistically significant. This has been consistently observed in other studies [2,9,18]. The increased operative time is often linked to technical demands and equipment setup, but with improved surgical expertise, the difference diminishes over time.[19]

Overall, this study adds to the growing body of literature demonstrating the benefits of laparoscopic appendectomy. In our context, LA proved advantageous in terms of reduced pain, lower additional analgesic requirements, fewer wound infections, and quicker return to normal activity. Although hospital stay and operative time did not differ significantly, these parameters are often influenced by surgeon experience and institutional practices. Considering patient comfort, early recovery, and reduced wound complications, LA can be regarded as the superior approach in the management of acute appendicitis, even in resource-constrained settings like Pakistan.

Conclusion

This study demonstrates that laparoscopic appendectomy is superior to open appendectomy in terms of early post-operative outcomes. Patients undergoing laparoscopic surgery experienced significantly lower pain scores at 4 and 24 hours, required fewer additional analgesics, had fewer wound infections, and returned to normal daily activities earlier. Although operative time and hospital stay were not significantly different between the two groups, the overall benefits of reduced discomfort, faster recovery, and lower complication rates favor laparoscopic appendectomy as the preferred approach for managing acute appendicitis. These findings support the adoption of laparoscopy as a safe and effective alternative to open surgery, even in resource-limited settings.

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