

An observational study to compare among open versus laparoscopic appendectomy to assess duration and quality of operation

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Abstract

Introduction: Acute appendicitis is a prevalent surgical emergency that necessitates prompt intervention to prevent severe complications such as perforation and peritonitis. Appendectomy, either open or laparoscopic, is the standard treatment. While open appendectomy has been the traditional method, laparoscopic appendectomy has emerged as a less invasive alternative with potential advantages in recovery and postoperative outcomes.

Objective: This study aims to compare the outcomes of laparoscopic appendectomy (LA) and open appendectomy (OA) in patients with acute appendicitis, focusing on postoperative pain, analgesic use, recovery of bowel and oral activity, complication rates, duration of hospital stay, and full recovery time.

Methods: An observational prospective study was conducted at Shri V.N. Government Medical College,

Yavatmal, involving 120 patients diagnosed with acute appendicitis. Patients were divided into LA (n=65) and OA (n=55) groups. Outcomes were assessed using a visual analogue scale for pain, recorded analgesic use, and monitored recovery metrics, including bowel and oral activity resumption, complications, hospital stay duration, and full recovery time.

Results: The study found significant differences between LA and OA groups. LA patients experienced less postoperative pain (p=0.026), required fewer analgesics (p=0.0001), had quicker bowel activity recovery (p=0.0109), and resumed oral intake faster (p=0.0021). Additionally, LA patients had fewer complications (p=0.0021), shorter hospital stays (p=0.0071), and faster full recovery (p=0.0189) compared to OA patients.

Conclusion: Laparoscopic appendectomy offers superior postoperative outcomes compared to open appendectomy, including reduced pain, quicker recovery, and fewer complications. These findings suggest that LA should be preferred for treating acute appendicitis, though further studies are needed to address study limitations such as its single-center design and lack of randomization.

Keywords: Acute Appendicitis, Laparoscopic Appendectomy, Open Appendectomy, Postoperative Pain, Recovery Time, Surgical Outcomes, Complications.

Introduction

Acute appendicitis is one of the most common and urgent surgical emergencies worldwide, imposing a considerable burden on healthcare systems. Prompt surgical intervention is crucial to prevent potentially severe complications such as perforation, abscess formation, and peritonitis¹. The standard treatment for appendicitis is an appendectomy, which involves the surgical removal of the inflamed appendix, a small pouch attached to the large intestine located in the lower right portion of the abdomen².

Despite its seemingly vestigial nature, the appendix can become inflamed, resulting in appendicitis. When this occurs, the appendix becomes swollen and painful, often requiring immediate medical attention to avoid the severe consequences of a potential rupture³. The urgency in treating appendicitis primarily stems from the risk of appendiceal perforation, which can lead to the spillage of infectious material into the abdominal cavity, subsequently causing peritonitis. Peritonitis, a serious inflammation of the abdominal lining, poses significant health risks, including systemic infection and organ failure if not promptly treated. Therefore, timely surgical

removal of the inflamed appendix is essential to prevent the progression of appendicitis to this life-threatening state⁴.

Appendectomy remains the cornerstone of treatment for appendicitis, aimed at eliminating the source of inflammation and preventing further complications. Traditionally, this surgical procedure involves making a single, larger incision in the lower right abdomen to access and remove the appendix⁵. This method, known as open appendectomy, has been widely practiced for over a century. However, despite its effectiveness, open appendectomy has certain drawbacks, including increased postoperative pain, longer recovery times, and a higher risk of wound infections due to the larger incision and associated tissue trauma⁶.

In recent years, laparoscopic appendectomy has emerged as a less invasive alternative to the traditional open method. This technique involves making several small incisions in the abdomen, through which a laparoscope—a slender instrument equipped with a camera—and other specialized tools are inserted to visualize and remove the appendix⁷. By minimizing tissue trauma and reducing the size of the incisions, laparoscopic appendectomy offers several advantages over open surgery. These include decreased postoperative pain, shorter hospital stays, quicker recovery, and improved cosmetic outcomes, making it an increasingly preferred option for both patients and surgeons⁸.

The management of acute appendicitis necessitates timely surgical intervention, as delays can lead to complications such as perforation, which significantly increases morbidity. While both laparoscopic and open appendectomies are viable options, the choice of procedure often depends on factors such as surgeon

expertise, patient characteristics, and available hospital resources⁹. Although the exact cause of appendicitis remains uncertain, the use of imaging techniques has become more common, enhancing preoperative diagnostic accuracy and reducing unnecessary surgeries. In some cases, surgery may be performed without imaging, but this approach is typically reserved for clear-cut cases¹⁰.

Appendectomy, whether performed through traditional open surgery or using laparoscopic techniques, serves as a critical intervention in the management of appendicitis. The open appendectomy, first described by McBurney over a century ago, involves a 2 to 4-inch incision in the lower right abdomen, providing direct access to the inflamed appendix¹¹. While this method has been the gold standard for many years, it is associated with significant postoperative pain, extended recovery times, and a higher risk of wound infections due to the larger incision required¹².

Patients undergoing open appendectomy often experience prolonged recovery times, which can be particularly challenging for those with demanding jobs or busy schedules. The larger incision also poses a higher risk of wound infections, which can complicate recovery and necessitate additional treatment. Furthermore, from an aesthetic perspective, the prominent scar left by the open procedure can affect patients' body image and self-esteem, especially if the scar is visible or pronounced¹³.

In light of these drawbacks, laparoscopic appendectomy has gained traction as a less invasive alternative. This technique involves smaller incisions and uses a camera-equipped laparoscope to guide the removal of the appendix. Laparoscopic appendectomy offers reduced postoperative pain, shorter recovery times, lower risk of

wound infections, and better cosmetic outcomes. These benefits have contributed to its growing popularity among both patients and healthcare providers¹⁴.

The choice between open and laparoscopic appendectomy depends on factors like surgeon expertise, patient characteristics, and institutional protocols. Laparoscopic appendectomy is favored for uncomplicated cases, but debate persists regarding its optimality, especially concerning operation duration and quality¹⁵. Shorter operation times are preferred for reducing anesthesia exposure and complications, while quality involves precision, hemostasis, and avoiding organ injury. Despite numerous studies comparing these methods, high-quality evidence on operation duration and quality remains limited. Observational studies can provide valuable insights by examining real-world practices and outcomes beyond the scope of randomized trials¹⁶.

The aim of this study is to compare the outcomes of laparoscopic appendectomy and open appendectomy in patients with acute appendicitis, focusing on postoperative quality of life, postoperative pain, the number of narcotics/analgesics used, length of hospital stays, and time to full recovery.

Materials and Methods

This observational prospective study was conducted at Shri V.N. Government Medical College, Yavatmal, to compare the outcomes of open versus laparoscopic appendectomy in patients diagnosed with acute appendicitis. The study included patients admitted with right iliac fossa pain, diagnosed with appendicitis, and meeting specific inclusion criteria, such as being of any age, gender, and free from systemic illness. Exclusion criteria included the presence of a right iliac fossa lump, pregnancy, perforated appendix, previous abdominal

surgery, or unwillingness to participate. Participants provided informed consent to be enrolled in the study.

Results

The study included 120 subjects with a statistically significant age distribution (p=0.0139), indicating that the age differences among participants were unlikely to be random. The majority were within the 18-30 age range (40.83%), followed by 31-40 years (38.33%) and 41-45 years (25%), suggesting a younger cohort. The gender distribution showed more males (56.66%) than females (43.34%); however, this difference was not statistically significant (p=0.1441), suggesting that the gender variation could be due to random chance.

Table 1: Age and Gender distribution between two study surgery types

		LA (n=65)	OA (n=55)	p-value
AGE	18-30	25	24	0.76
	31-40	25	21	
	41-45	15	10	
Gender	Male	36	32	0.90
	Female	29	23	

When comparing age and gender distribution between laparoscopic appendectomy (LA) and open appendectomy (OA), no significant differences were observed. Age distribution (p=0.76) was similar, with subjects aged 18-30, 31-40, and 41-45 evenly split between LA (25, 25, and 15 subjects, respectively) and OA (24, 21, and 10 subjects, respectively). Gender distribution was also comparable, with 36 males and 29 females in the LA group, and 32 males and 23 females in the OA group (p=0.90). These non-significant p-values suggest that age and gender were evenly distributed, indicating that demographic factors did not influence outcome differences between the surgery types.

Table 2: Table for the association of type of surgery with the POST OP Pain

Surgery Type	POST OP PAIN (on visual analogue scale)							p-value
	DAY 1			DAY3		Day 5	Day 7	
	1-2	3-5	6-7	1-2	3-5	1-2	1-2	
LA (%) (n=65)	0	30 (46)	2 (3.0)	19 (29.2)	5 (7.6)	6 (9.2)	1 (1.53)	0.026
OA (%) (n=55)	0	21 (38)	7 (12.7)	17 (30.9)	10 (18)	14 (25)	6 (10.91)	

Post-operative pain, assessed using a visual analogue scale, revealed significant differences between the two surgery types (p=0.026). On day 1, 49% of LA patients reported pain levels of 3-5, compared to 35% of OA patients. By day 5, 8% of LA patients reported pain levels of 3-5, whereas 16% of OA patients reported similar pain levels, indicating less pain in the LA group. On day 7, 10.91% of OA patients reported pain levels of 6-7, compared to only 1.53% of LA patients. These findings suggest that LA patients experienced significantly less post-operative pain, particularly on days 5 and 7.

Table 3: Table for the association of type of surgery with the Use of Analgesic

Surgery type	USE OF ANALGESIC (in mg)						p-value
	DAY 1 (50-150)		DAY 3 (50-100)		Day 5 (50)	Day 7 (50)	
	50	≥100	50	100	50	50	
LA (%) (n=65)	31 (47.69)	34 (52.3)	41 (63.0)	23 (35.3)	12 (18.4)	2 (3.0)	0.0001
OA (%) (n=55)	12 (21)	43 (78.18)	13 (23)	42 (76.3)	26 (47.27)	7 (12.73)	

The use of analgesics post-surgery differed significantly between the LA and OA groups ($p=0.0001$). On day 1, 78.18% of OA patients required ≥ 100 mg of analgesics, compared to 52.3% of LA patients. This pattern continued on day 3, with 76.3% of OA patients needing 100 mg of analgesics, while only 35.3% of LA patients required the same amount. By day 5, 47.27% of OA patients still needed analgesics, compared to just 18.4% of LA patients. The highly significant p-value indicates that LA patients required substantially less analgesic use post-operatively compared to OA patients.

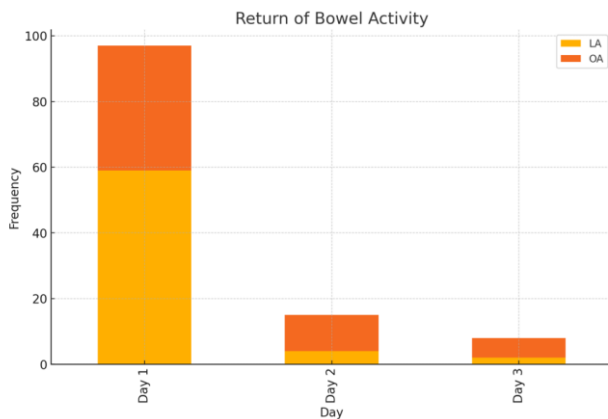


Figure 1: The association of type of surgery with the Return of Bowel Activity

This figure illustrates the return of bowel activity post-operation between LA and OA patients over days 1, 2, and 3. On day 1, 90.7% of LA patients had resumed bowel activity, compared to 69.09% of OA patients. By day 3, only 3.07% of LA patients had not regained bowel function, whereas 10.9% of OA patients were still awaiting its return. The significant p-value of 0.0109 suggests that LA patients experienced a quicker return of bowel activity post-surgery compared to OA patients.

Table 4: Table for the association of type of surgery with the Oral Activity POST OP

Surgery type	ORAL ACTIVITY POST OP			p-value
	DAY 1	DAY 2	Day 3	
LA (%) (n=65)	41 (63.07)	13 (20.00)	11 (16.92)	0.0021
OA (%) (n=55)	24 (43.63)	12 (21.81)	19 (34.54)	

The data highlights a significant association between the type of surgery and the resumption of oral activity post-operation. Patients who underwent laparoscopic appendectomy (LA) resumed oral activity significantly faster than those who had an open appendectomy (OA). On day 1 post-operation, 63.07% of LA patients had resumed oral intake, compared to only 43.63% of OA patients ($p=0.0021$). By day 3, 16.92% of LA patients had resumed oral activity, while 34.54% of OA patients had not. The p-value of 0.0021 underscores a statistically significant difference, indicating that LA facilitates quicker recovery in terms of oral activity resumption compared to OA.

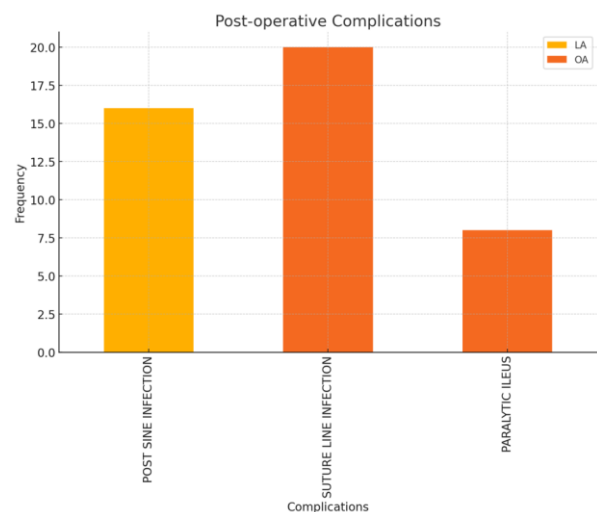


Figure 2: The association of type of surgery with the Complications

The comparison of post-surgery complications between LA and OA patients reveals distinct differences in the types of complications experienced. The LA group primarily faced post-sine infections (24.61%), whereas the OA group had higher rates of suture line infections (36.36%) and paralytic ileus (14.54%). The p-value of 0.0021 indicates a significant difference between the two groups, suggesting that OA patients encountered more severe complications, particularly with a higher incidence of suture line infections and paralytic ileus, compared to LA patients.

Table 5: Table for the association of type of surgery with the Duration of Stay in hospital

Surgery type	Duration of Stay in hospital			p-value
	Day 2-3	Day 4-6	Day 6-8	
LA (%)	38 (58.46)	23 (35.38)	4 (6.15)	0.0071
OA (%)	21 (38.18)	20 (36.36)	14 (25.45)	

The duration of hospital stays post-surgery showed a significant difference between LA and OA patients (p=0.0071). Most LA patients (58.46%) were discharged within 2-3 days, while a considerable portion of OA patients (25.45%) remained hospitalized for 6-8 days, compared to only 6.15% of LA patients. This significant p-value indicates that LA patients experienced shorter hospital stays, suggesting a faster overall recovery process compared to OA patients.

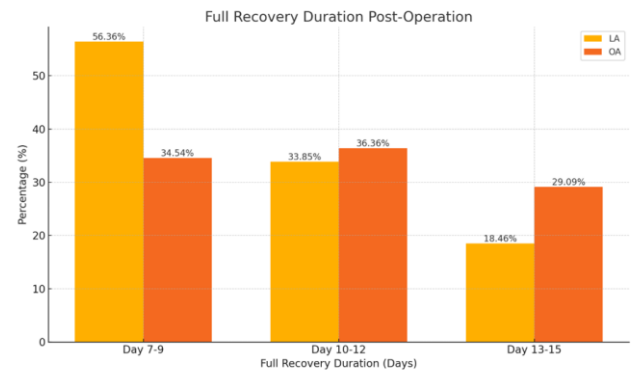


Figure 3: The association of type of surgery with the Full recovery duration

The graph illustrates the full recovery duration post-operation for patients undergoing laparoscopic appendectomy (LA) and open appendectomy (OA) across three time intervals. By days 7-9, 56.36% of LA patients had fully recovered, in contrast to 34.54% of OA patients. This trend continues with 33.85% of LA patients fully recovered by days 10-12, compared to 36.36% of OA patients. By days 13-15, 18.46% of LA patients had fully recovered, while 29.09% of OA patients were still in recovery. The visual data underscores the significant difference (p=0.0189) favoring LA for a quicker full recovery compared to OA.

Discussion

Appendectomy, a common emergency surgery for acute appendicitis, can be performed through traditional open surgery or laparoscopic methods. Open appendectomy, established in 1894, involves a single large incision, offering reliability, especially in complicated cases. Laparoscopic appendectomy, introduced in 1983, uses small incisions and a camera, providing benefits like reduced pain and quicker recovery but requiring advanced equipment. This study compares the two techniques, focusing on operation duration, complication rates, and patient outcomes, aiming to guide surgical

practice and improve care for acute appendicitis patients¹⁷.

Our study of 120 subjects revealed a significant age distribution ($p=0.0139$), with most aged 18-30 (40.83%). Gender distribution, more males (56.66%) than females (43.34%), was not statistically significant ($p=0.1441$), indicating random variation. These findings align with previous studies by Nazir A et al. (2019) and Sauerland S et al. (2010)^{18,19}.

Our findings showed no significant differences in age ($p=0.76$) or gender ($p=0.90$) distribution between laparoscopic (LA) and open appendectomy (OA) groups, consistent with Takami T et al. (2020) and Nazir A et al. (2019). Age and gender were evenly distributed, suggesting these demographic factors did not influence outcomes^{20,18}.

Our findings reveal significant differences in post-operative pain between laparoscopic (LA) and open appendectomy (OA) ($p=0.026$), with LA patients reporting less pain. By day 7, only 1.53% of LA patients had higher pain levels compared to 10.91% of OA patients. These results align with Biondi A et al. (2016) and Sauerland S et al. (2010)^{21,19}.

Our study reveals a significant difference in post-surgery analgesic use between laparoscopic (LA) and open appendectomy (OA) ($p=0.0001$), with OA patients requiring more analgesics. These findings align with Islam SR et al. (2014) and Sauerland S et al. (2010), both reporting higher analgesic use in OA compared to LA patients^{22,19}.

Our findings reveal a significant difference in post-operative bowel activity between laparoscopic (LA) and open appendectomy (OA) patients ($p=0.0109$). By day 1, 90.7% of LA patients resumed bowel activity versus

69.09% of OA patients. These results align with Takami T et al. (2020) and Sauerland S et al. (2010)^{20,19}.

Our findings indicate a significant association between surgery type and the resumption of oral activity post-operation ($p=0.0021$). On day 1, 63.07% of LA patients resumed oral activity versus 43.63% of OA patients. These results are consistent with Wani IA et al. (2020) and Takami T et al. (2020)^{23,20}.

Our findings reveal significant differences in post-operative complications between LA and OA patients ($p=0.0021$), with OA patients experiencing more severe issues like suture line infections (36.36%) and paralytic ileus (14.54%). These results align with Nikolov NK et al. (2024) and Takami T et al. (2020), indicating higher complications in OA patients^{24,20}.

Our findings show significant differences in hospital stay duration between LA and OA patients ($p=0.0071$), with 58.46% of LA patients discharged within 2-3 days versus 25.45% of OA patients staying 6-8 days. These results align with Sauerland S et al. (2010) and Takami T et al. (2020), suggesting faster recovery for LA patients^{19,20}.

Our findings reveal a significant association between surgery type and full recovery duration ($p=0.0189$), with 56.36% of LA patients fully recovered by days 7-9 versus 34.54% of OA patients. These results align with Fujishiro J et al. (2021) and Sauerland S et al. (2010), indicating quicker recovery for LA patients^{25,19}.

Conclusion

The study at Shri V.N. Government Medical College, Yavatmal, compared laparoscopic (LA) and open appendectomy (OA) for acute appendicitis, focusing on postoperative outcomes such as quality of life, pain, analgesic use, bowel and oral activity, complication rates, hospital stay, and recovery time. LA patients

experienced significantly less pain, required fewer analgesics, and had a quicker return to normal activities. They also had fewer complications, shorter hospital stays, and faster recovery times. These findings suggest that LA offers superior postoperative outcomes and should be preferred over OA for treating acute appendicitis. However, limitations like the single-center design, lack of randomization, and short-term follow-up should be considered.

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