International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2023: 1.843

A Prospective Clinical Comparative Study of Clinical Outcome of Laparoscopic vs Open Appendicectomy in Tertiary Healthcare Center

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Abstract: ***Objective**: To evaluate the prospective clinical comparative study of clinical outcomes of laparoscopic vs open appendicectomy. **Methods**: We conducted a prospective analysis of 200 acute appendicitis cases admitted to our institution. Among these, 100 (50%) underwent laparoscopic appendicectomy and 100 (50%) underwent open appendicectomy. Clinical outcomes were compared between the 2 groups in relation to operative time, analgesia used, length of hospital stay, return to work, resumption of a regular diet, postoperative complications, cosmoses and conversion rate. **Results**: The mean age for laparoscopic appendectomy patients was 24.5 years, while for open appendectomy it was 24.0 years. In terms of gender, 70 males and 30 females underwent laparoscopic appendectomy, compared to 65 males and 35 females in the open appendectomy. The mean WBC count was slightly higher in the laparoscopic group (12.8 ± 1.25) compared to the open group (12.5 ± 1.25). BMI values were also comparable between groups, with a mean of 22.5 ± 2.75 in the laparoscopic group and 21.5 ± 3.5 in the open group. For operative findings, 80 patients in the laparoscopic group had an inflamed appendix, while 75 in the open group did. Regarding ultrasound findings, 65 patients in the laparoscopic group had inflamed appendices, compared to 80 in the open group, while normal - looking appendices were noted in 35 and 20 patients, respectively. . Histopathologically, the presence of an inflamed appendix was confirmed in 86 laparoscopic cases and 87 open cases, while normal appendices were seen in 14 laparoscopic and 13 open cases. The operative time was significantly longer for the laparoscopic group (52 ± 15.0 minutes) compared to the open group (30 ± 12.5 minutes). Laparoscopic appendectomy patients required fewer doses of parenteral analgesics (0.95 ± 0.45) compared to open appendectomy patients (1.5 ± 0.5). Oral analgesic use was similar between groups. Laparoscopic patients resumed oral intake faster (18.5 ± 2.75 hours) than open patients (24.5 ± 4.5 hours). Hospital stay was significantly shorter in the laparoscopic group (1.5 ± 0.75 days) compared to the open group (3.25 ± 1.25 days). Additionally, laparoscopic patients returned to normal activity sooner (11.5 ± 3.5 days) than open appendectomy patients (20.5 ± 3.5 days). Overall, laparoscopic appendectomy was associated with better postoperative recovery outcomes **Conclusion**: The comparison between laparoscopic and open appendectomy shows that while patient demographics and preoperative findings are similar between the two groups, laparoscopic appendectomy offers significant advantages in postoperative outcomes and complications. Although the operative time for laparoscopic surgery is longer, it results in faster recovery, as evidenced by reduced parenteral analgesic requirements, earlier resumption of oral intake, shorter hospital stays, and quicker return to normal activity. Furthermore, laparoscopic appendectomy is associated with fewer postoperative complications, including a lower incidence of vomiting, paralytic ileus, wound infections, and no cases of wound dehiscence. These findings suggest that laparoscopic appendectomy is a more favorable option for patients, offering improved postoperative recovery and fewer complications compared to the open appendectomy approach.***

Keywords: laparoscopic appendectomy, open appendectomy, postoperative recovery, acute appendicitis, clinical outcomes

1. Introduction

Acute appendicitis, the most common reason for abdominal surgery in children and the leading abdominal surgical emergency globally, involves inflammation of the vermiform appendix. Patients usually seek emergency care within 24 hours of symptom onset. Although primary antibiotic therapy has improved the management of acute appendicitis, surgery remains the definitive treatment. Laparoscopic and open surgery are widely used for the treatment of acute appendicitis, yet they differ significantly in terms of invasiveness, recovery time, complication rates, and overall patient outcomes. Laparoscopic appendicectomy is often favoured for its minimally invasive nature, which typically results in shorter hospital stays and quicker recovery times. However, open appendicectomy has long been the standard treatment and is sometimes preferred in cases of complicated appendicitis or where laparoscopic facilities are unavailable. The purpose of this study is to conduct a prospective clinical comparative analysis to objectively assess and compare the clinical outcomes of laparoscopic versus open appendicectomy. By examining hospital records of patients admitted with acute appendicitis and undergoing surgical management, this research aims to provide valuable insights into the efficacy, safety, and overall benefits of each surgical approach within the context of a tertiary care hospital. This, in turn, will help inform clinical decisions and potentially guide best practices in the treatment of acute appendicitis.

2. Material and Methods

It is prospective analysis of patients of acute appendicitis underwent surgical interventions at VDGMC from 2022 - 24. data collected and assessed for Preop op imaging findings and

outcome after surgical intervention.

Diagnosis of Acute Appendcts

The diagnosis of acute appendicitis was made thorough history and detailed clinical examination. Complete blood picture, total and differential white blood cell counts, abdominal X - ray and ultrasonography.

Management

Patients with the clinical diagnosis of acute appendicitis were divided into two groups. The first group included patients undergoing laparoscopic appendicectomy (LA) and the second group included patients undergoing open appendicectomy (OA). Patients who were managed exclusively by conservative management and did not undergo appendicectomy were excluded out of the study. Clinical outcomes were compared between the 2 groups in relation to operative time, analgesia used, length of hospital stay, return to work, resumption of a regular diet, postoperative complications, cosmoses and conversion rate.

3. Result

Table 1: Distribution of the Patients according to the Demographic Details.

S. No.	Characteristics	Laparoscopic Appendectomy	Open Appendectomy (Mean + SD)	P Value
1	Age (Mean + SD)	24.5 + 5.0	24.0 + 8.0	0.543
2	Male (Numbers)	70	65	0.645
	Female	30	35	0.776
3	WBC Count ((Mean + SD)	12.8 + 1.25	12.5 + 1.25	0.887
4	BMI (Mean + SD)	22.5 + 2.75	21.5 + 3.5	0.978

The table presents the demographic distribution of patients undergoing laparoscopic and open appendectomy. The mean age for laparoscopic appendectomy patients was 24.5 years (± 5.0), while for open appendectomy it was 24.0 years (± 8.0), with no statistically significant difference ($p = 0.543$). In terms of gender, 70 males and 30 females underwent laparoscopic appendectomy, compared to 65 males and 35 females in the open appendectomy group, showing no significant differences ($p = 0.645$ for males and 0.776 for females). The mean WBC count was slightly higher in the laparoscopic group (12.8 ± 1.25) compared to the open group (12.5 ± 1.25), with no statistical significance ($p = 0.887$). BMI values were also comparable between groups, with a mean of 22.5 ± 2.75 in the laparoscopic group and 21.5 ± 3.5 in the open group, with a non - significant p - value of 0.978. Overall, the demographic characteristics between the two surgical groups were similar, with no significant differences.

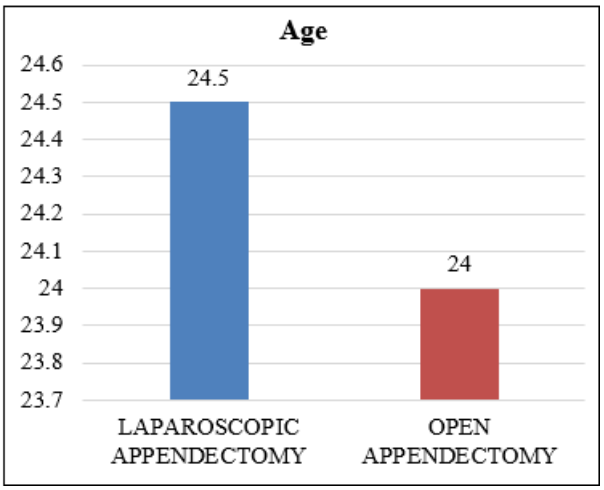

Figure 1 (A): Age

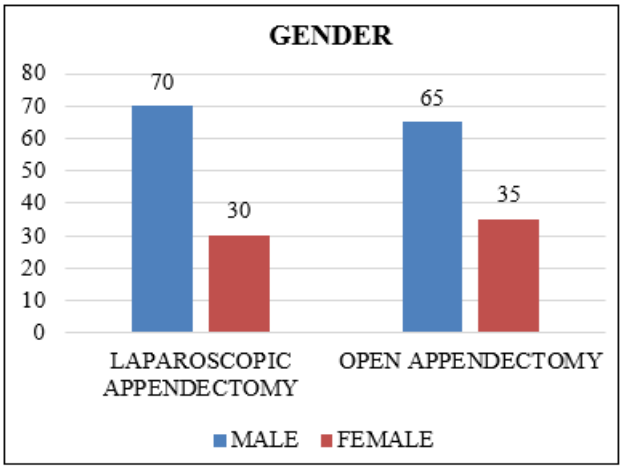

Figure 1 (B): Gender

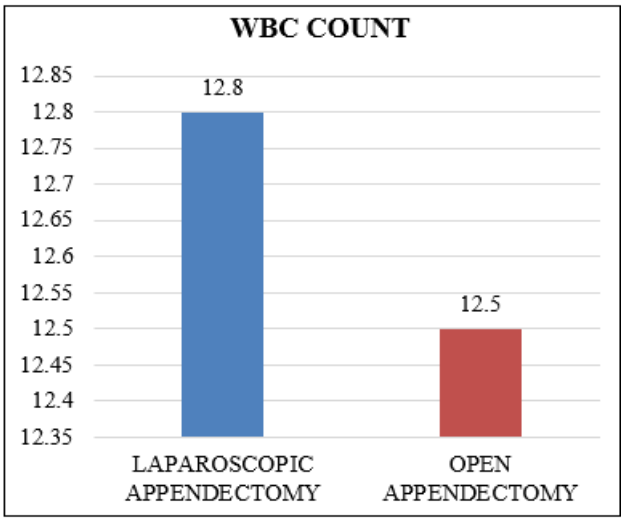

Figure 1 (C): WBC Count

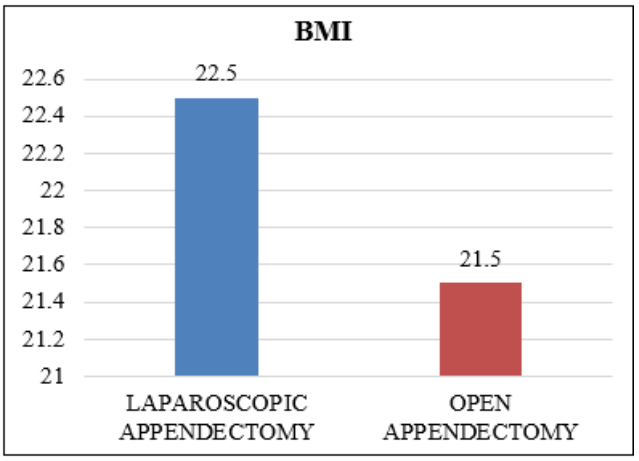

Figure 1 (D): BMI

Table 2: Comparison of Variable between the Groups
Preoperative Histopathological and Ultrasound Findings

Parameters	Laparoscopic Appendectomy	Open Appendectomy	P Value*
Operative			
Inflamed appendix	80	75	0.68
Normal looking appendix	20	25	
Histopathological			
Inflamed appendix	86	87	NS
Normal looking appendix	14	13	
Ultrasound			
Inflamed appendix	65	80	0.56
Normal looking appendix	35	20	

The table compares preoperative histopathological and ultrasound findings between patients undergoing laparoscopic and open appendectomy. For operative findings, 80 patients in the laparoscopic group had an inflamed appendix, while 75 in the open group did, with no significant difference (p = 0.68). Histopathologic ally, the presence of an inflamed appendix was confirmed in 86 laparoscopic cases and 87 open cases, while normal appendices were seen in 14 laparoscopic and 13 open cases, showing no statistically significant difference (NS). Regarding ultrasound findings, 65 patients in the laparoscopic group had inflamed appendices, compared to 80 in the open group, while normal - looking appendices were noted in 35 and 20 patients, respectively, with no significant difference (p = 0.56). Overall, both groups showed similar distributions in operative, histopathological, and ultrasound findings, with no significant variations.

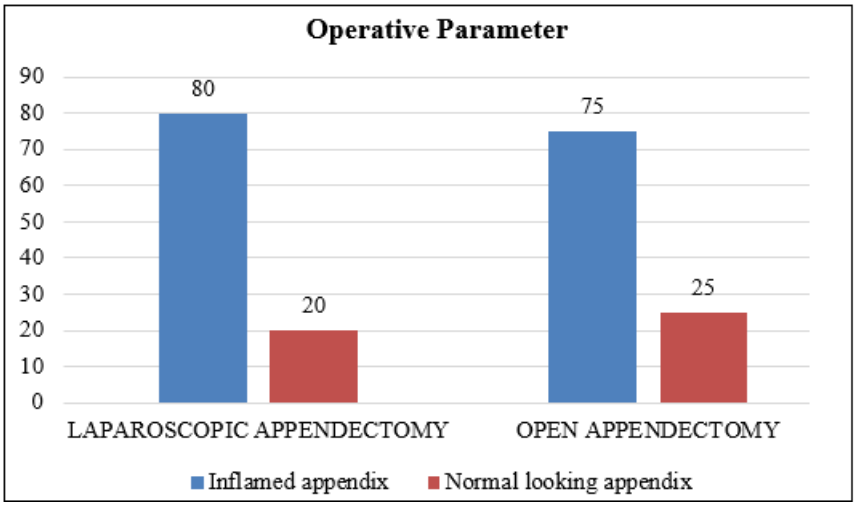

Table 2 (A): Operative Parameter

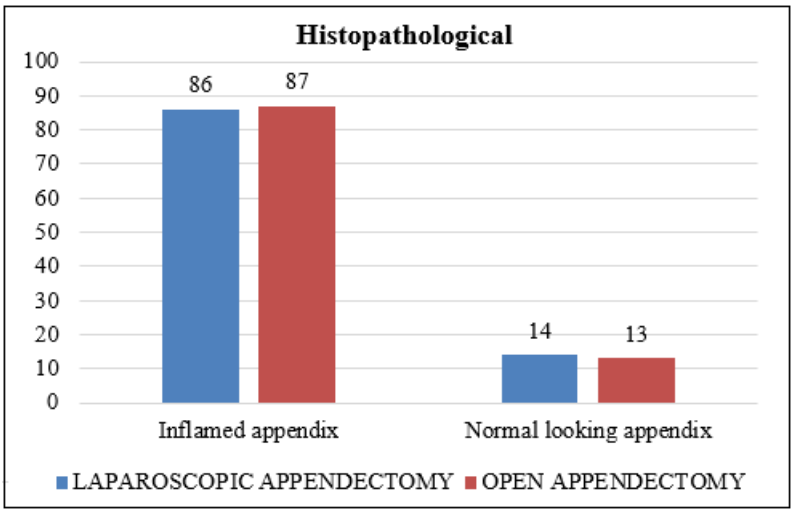

Figure 2 (B): Histopathological Parameter

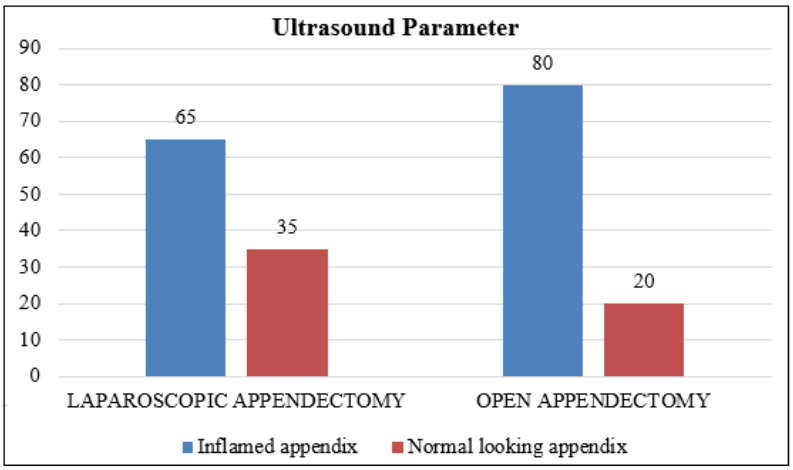

Figure 2 (C): Ultrasound Parameter

Table 3: Postoperative Subjective Outcome

Postoperative Subjective Outcome	Laparoscopic Appendectomy	Open Appendectomy	P Value*
Operative time (min)	52 + 15.0	30 + 12.5	<0.001
Parenteral analgesics (doses)	0.95 + 0.45	1.5 + 0.5	0.001
Oral analgesics (doses)	2.75 + 0.75	2.75 + 1.25	0.05
Time to oral intake (hrs)	18.5 + 2.75	24.5 + 4.5	0.02
Hospital stays (d)	1.5 + 0.75	3.25 + 1.25	<0.001
Returned to normal activity (d)	11.5 + 3.5	20.5 + 3.5	<0.001

The table compares postoperative subjective outcomes between patients undergoing laparoscopic and open appendectomy. The operative time was significantly longer for the laparoscopic group (52 ± 15.0 minutes) compared to the open group (30 ± 12.5 minutes) ($p < 0.001$). Laparoscopic appendectomy patients required fewer doses of parenteral analgesics (0.95 ± 0.45) compared to open appendectomy patients (1.5 ± 0.5), with a significant difference ($p = 0.001$). Oral analgesic use was similar between groups, though marginally significant ($p = 0.05$). Laparoscopic patients resumed oral intake faster (18.5 ± 2.75 hours) than open patients (24.5 ± 4.5 hours) ($p = 0.02$). Hospital stay was significantly shorter in the laparoscopic group (1.5 ± 0.75 days) compared to the open group (3.25 ± 1.25 days) ($p < 0.001$). Additionally, laparoscopic patients returned to normal activity sooner (11.5 ± 3.5 days) than open appendectomy patients (20.5 ± 3.5 days), with a highly significant difference ($p < 0.001$). Overall, laparoscopic appendectomy was associated with better postoperative recovery outcomes.

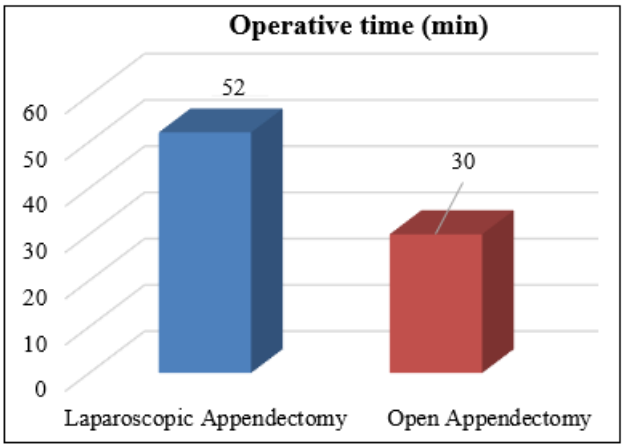

Figure 3 (A): Operating Time

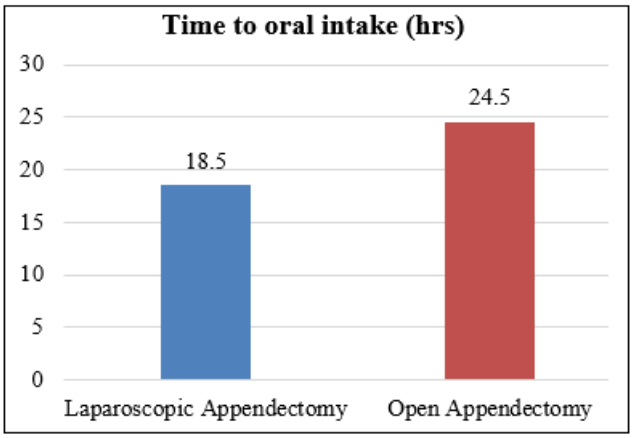

Figure 3 (B): Time to take oral intake. (hrs)

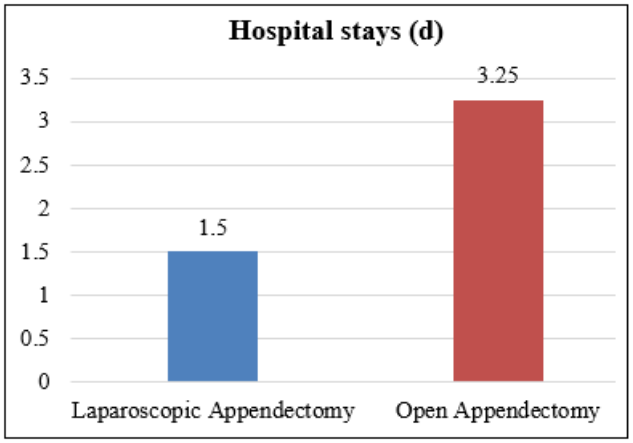

Figure 3 (C): Hospital Stays (D)

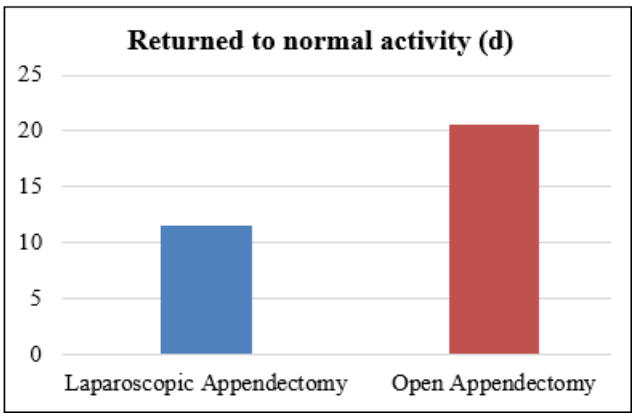

Figure 3 (D): Returned to normal activity (d).

Table 4: Postoperative Complications.

Minor and Major Complications	Laparoscopic Appendectomy	Open Appendectomy	P Value*
Minor			
Vomiting	**15**	**45**	**0.001**
Paralytic ileus	**8**	**17**	**0.05**
Wound infection	**6**	**14**	**0.02**
Major			
Wound dehiscence	**0**	**3**	**HS**

The table compares postoperative complications between laparoscopic and open appendectomy groups. In terms of minor complications, vomiting occurred significantly less frequently in the laparoscopic group (15 cases) compared to the open group (45 cases), with a significant p - value of 0.001. Paralytic ileus was observed in 8 laparoscopic cases versus 17 open cases, with a marginal significance (p = 0.05). Wound infections were also significantly lower in the laparoscopic group (6 cases) compared to the open group (14 cases) (p = 0.02). Among major complications, wound dehiscence occurred in 3 cases in the open group, but none in the laparoscopic group, with the result being highly

significant (HS). Overall, laparoscopic appendectomy had fewer postoperative complications, both minor and major, compared to open appendectomy.

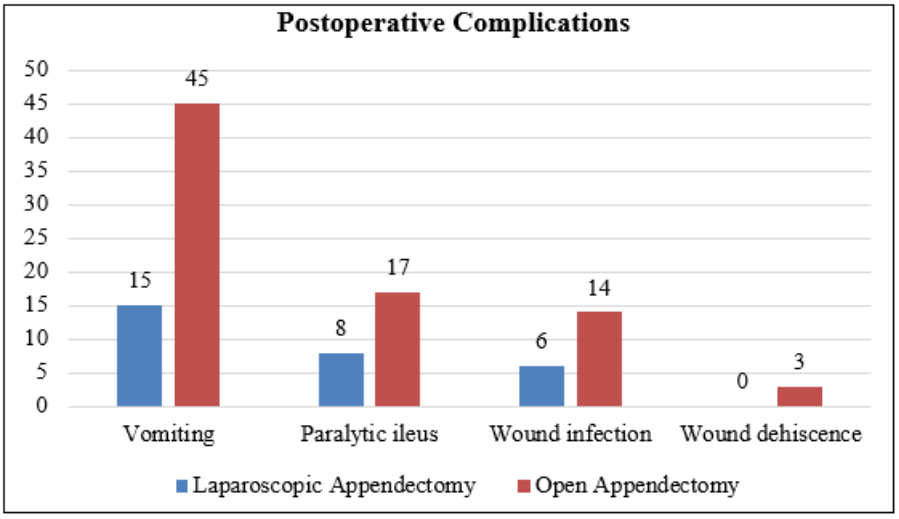

Figure 4 (A): Postoperative Complications

4. Discussion

Demographic Details (Age, Gender, WBC Count and BMI)

The present study evaluated the demographic characteristics of patients undergoing laparoscopic appendectomy (LA) and open appendectomy (OA). The mean age of patients in the LA group was 24.5 ± 5.0 years, while it was 24.0 ± 8.0 years for the OA group, with no significant difference between the two (P = 0.543). The gender distribution showed that 70% of the patients in the LA group were male, compared to 65% in the OA group, with a P - value of 0.645, indicating no significant difference. Similarly, female patients constituted 30% of the LA group and 35% of the OA group, with a P - value of 0.776. The white blood cell (WBC) count was comparable between the two groups, with mean values of 12.8 ± 1.25 for LA and 12.5 ± 1.25 for OA (P = 0.887). The body mass index (BMI) also showed no significant difference, with a mean of 22.5 ± 2.75 for LA and 21.5 ± 3.5 for OA (P = 0.978).

Abdul Razak Shaikh et al. (2009) conducted a similar study examining the demographic profile of patients undergoing laparoscopic and open appendectomy. The mean age of patients in the LA group was 25.8 ± 6.0 years, while it was 25.5 ± 9.7 years for the OA group, with no significant difference (P = 0.84). The gender distribution in their study showed that 72.9% of the LA patients were male, compared to 65.4% in the OA group. Females made up 27.1% of the LA group and 34.6% of the OA group, with a P - value of 0.51, indicating no statistically significant difference. The mean WBC count for LA patients was 13.5 ± 1.04, compared to 13.8 ± 1.3 for OA patients, with no significant difference (P = 0.14).

Both the present study and the study by Abdul Razak Shaikh et al. (2009) demonstrated no significant differences in demographic characteristics between patients undergoing laparoscopic and open appendectomy. In both studies, age, sex, and WBC count were comparable between the groups, with no statistically significant differences. The BMI values were also similar in the present study, although this parameter was not assessed in the study by Abdul Razak Shaikh et al. The consistency of these findings suggests that demographic factors do not play a significant role in determining the choice between laparoscopic and open appendectomy in these patient populations.

Preoperative, Histopathological and Ultrasound Findings

The present study compared preoperative histopathological and ultrasound findings between patients undergoing laparoscopic appendectomy (LA) and open appendectomy (OA). Operative findings revealed that 80% of patients in the LA group had an inflamed appendix, while 75% of OA patients had the same finding, with no significant difference (P = 0.68). In contrast, 20% of the LA group and 25% of the OA group had a normal - looking appendix. Histopathological findings showed similar results between the two groups, with 86% of LA patients and 87% of OA patients having an inflamed appendix, while 14% and 13%, respectively, had a normal appendix, and these differences were not significant (NS). Ultrasound findings indicated an inflamed appendix in 65% of LA patients and 80% of OA patients, with normal findings in 35% of LA and 20% of OA patients, yielding a P - value of 0.56.

Abdul Razak Shaikh et al. (2009) also evaluated preoperative histopathological and ultrasound findings in patients undergoing LA and OA. In the operative findings, 83.3% of LA patients had an inflamed appendix, while 89.6% of OA patients had similar findings, with no significant difference (P = 0.61). A normal - looking appendix was observed in 16.7% of LA patients and 10.4% of OA patients. Histopathological findings showed an inflamed appendix in 88.5% of LA patients and 78.8% of OA patients, with no statistically significant difference (NS). Ultrasound results indicated that 62.5% of LA patients and 78.8% of OA patients had an inflamed appendix, while 37.5% of LA and 21.2% of OA patients had normal ultrasound findings, with a P - value of 0.08, indicating no significant difference.

The comparison between the present study and the study by

Abdul Razak Shaikh et al. (2009) shows consistent findings regarding the preoperative histopathological and ultrasound evaluations in patients undergoing laparoscopic and open appendectomy. Both studies revealed that the majority of patients in both groups had an inflamed appendix, with no significant differences between the LA and OA groups in operative or histopathological findings. Similarly, ultrasound findings showed comparable proportions of inflamed appendices, although Abdul Razak Shaikh et al. 's study reported a slightly higher percentage of inflamed appendices in OA patients. Overall, the results suggest that there is no significant distinction between the two surgical methods based on preoperative diagnostic findings.

Postoperative Subjective Outcome

In this study, postoperative subjective outcomes were compared between patients undergoing laparoscopic appendectomy (LA) and open appendectomy (OA). The mean operative time for LA was 52 ± 15.0 minutes, significantly longer than the 30 ± 12.5 minutes for OA ($P < 0.001$). LA patients required fewer parenteral analgesic doses (0.95 ± 0.45) compared to OA patients (1.5 ± 0.5), with a significant difference ($P = 0.001$). Oral analgesic use was similar between the groups, with both requiring an average of 2.75 doses ($P = 0.05$). Time to oral intake was shorter for LA patients at 18.5 ± 2.75 hours, compared to 24.5 ± 4.5 hours for OA patients ($P = 0.02$). Hospital stays were significantly shorter for LA patients (1.5 ± 0.75 days) compared to OA patients (3.25 ± 1.25 days) ($P < 0.001$). Additionally, LA patients returned to normal activity faster, averaging 11.5 ± 3.5 days, compared to 20.5 ± 3.5 days for OA patients ($P < 0.001$).

Abdul Razak Shaikh et al. (2009) also compared postoperative outcomes between LA and OA patients. The mean operative time was longer for LA patients (54.9 ± 14.7 minutes) compared to OA patients (31.6 ± 12.6 minutes), with a significant difference ($P < 0.001$). Parenteral analgesic doses were lower in LA patients (1.0 ± 0.5) compared to OA patients (1.5 ± 0.6), showing a significant difference ($P = 0.001$). Oral analgesic use was slightly lower in LA patients (2.5 ± 0.8) compared to OA patients (3.0 ± 1.5), but this difference was not statistically significant ($P = 0.05$). Time to oral intake was shorter for LA patients (20.1 ± 2.9 hours) than for OA patients (22.0 ± 4.7 hours) ($P = 0.02$). LA patients had a shorter hospital stay (1.4 ± 0.7 days) compared to OA patients (3.4 ± 1.0 days) ($P < 0.001$), and they returned to normal activity sooner, averaging 12.6 ± 3.3 days for LA and 19.1 ± 3.1 days for OA ($P < 0.001$).

The comparison of postoperative subjective outcomes between the present study and the findings of Abdul Razak Shaikh et al. (2009) reveals similar trends. Both studies found that laparoscopic appendectomy took longer to perform than open appendectomy but was associated with shorter hospital stays, quicker return to normal activities, and reduced need for parenteral analgesics. Time to oral intake was also consistently shorter for LA patients across both studies. The consistency in these findings suggests that, while laparoscopic surgery may have a longer operative time, its postoperative benefits—including faster recovery and less pain—make it a preferable choice for many patients.

Postoperative Complications

In the present study, postoperative complications were evaluated for both laparoscopic appendectomy (LA) and open appendectomy (OA) groups. Minor complications were more common in the OA group, with 45 patients experiencing vomiting compared to 15 in the LA group, showing a significant difference ($P = 0.001$). Paralytic ileus was reported in 8 LA patients and 17 OA patients, with a statistically significant difference ($P = 0.05$). Wound infection occurred in 6 LA patients and 14 OA patients, also showing significance ($P = 0.02$). Regarding major complications, wound dehiscence was only observed in 3 OA patients, and no cases were reported in the LA group, with this difference being highly significant (HS).

In the study by Abdul Razak Shaikh et al. (2009), postoperative complications were also compared between the LA and OA groups. Among minor complications, vomiting was reported in 18.8% of LA patients and 51.9% of OA patients, showing a significant difference ($P = 0.001$). Paralytic ileus occurred in 6.3% of LA patients and 21.2% of OA patients ($P = 0.04$). Wound infections were more common in the OA group (13.7%) compared to the LA group (6.3%), though this difference was not statistically significant ($P = 0.32$). Major complications included wound dehiscence, which occurred in 1.9% of OA patients, while no cases were reported in the LA group. Other major complications, such as intra - abdominal abscesses and small bowel obstruction, were rare and showed no statistically significant differences between the groups.

Both the present study and the study by Abdul Razak Shaikh et al. (2009) demonstrated that minor postoperative complications, particularly vomiting, paralytic ileus, and wound infections, were more common in patients undergoing open appendectomy compared to those undergoing laparoscopic appendectomy. In both studies, vomiting was significantly more prevalent in the OA group, with P - values of 0.001 in both cases. Paralytic ileus and wound infections were also more frequent in OA patients in both studies, although some differences in significance were observed. Major complications, such as wound dehiscence, were rare but more frequently observed in the OA group across both studies. Overall, the findings suggest that laparoscopic appendectomy is associated with fewer postoperative complications compared to open appendectomy, reinforcing the benefits of minimally invasive surgery.

5. Conclusion

The comparison between laparoscopic and open appendectomy shows that while patient demographics and preoperative findings are similar between the two groups, laparoscopic appendectomy offers significant advantages in postoperative outcomes and complications. Although the operative time for laparoscopic surgery is longer, it results in faster recovery, as evidenced by reduced parenteral analgesic requirements, earlier resumption of oral intake, shorter hospital stays, and quicker return to normal activity. Furthermore, laparoscopic appendectomy is associated with fewer postoperative complications, including a lower incidence of vomiting, paralytic ileus, wound infections, and no cases of wound dehiscence. These findings suggest that

laparoscopic appendectomy is a more favourable option for patients, offering improved postoperative recovery and fewer complications compared to the open appendectomy approach

6. Limitations of the Study

1) **Small Sample Size**: The sample size for each group may be limited, reducing the statistical power to detect smaller differences between laparoscopic and open appendectomy outcomes.
2) **Single - Center Study**: If the study was conducted at a single center, the results may not be generalizable to other hospitals or regions with different patient populations and surgical techniques.
3) **Short Follow - Up Duration:** Postoperative outcomes and complications were likely observed over a limited period, possibly missing long - term complications or recurrences

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