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Comparison of Outcome between Laparoscopic and Open Appendectomies in Pakistani Patients

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ABSTRACT

Introduction: This study compares laparoscopic appendectomy (LA) and open appendectomy (OA) in Pakistani patients, focusing on operative time, blood loss, postoperative pain, recovery time, and complications. LA is recognized for its minimally invasive benefits, whereas OA is a conventional approach.

Methodology: In Fauji Foundation Hospital Peshawar Cantt, we undertook a randomized controlled experiment with eighty patients diagnosed with acute appendicitis. Patients were paired randomly to either LA or OA. We recorded operating time, intraoperative blood loss, postoperative pain (visual analog scale), analgesic use, hospital stay, and complications. The groups' outcomes were compared using statistical analyses comprising chi-square tests and t-tests.

Results: With LA (72.5 ± 15.3 minutes) the mean operative time was noticeably longer than OA (58.7 ± 12.9 minutes, $p = 0.001$). With less blood loss (45.2 ± 10.1 mL) LA produced than OA (78.4 ± 15.7 mL, $p < 0.001$). For LA (VAS 3.2 ± 1.1) postoperative pain levels were much lower than for OA (VAS 5.6 ± 1.3 , $p = 0.001$). Apart from OA (4.5 ± 1.1 days, $p < 0.001$) and a quicker resumption to activities (8.6 ± 2.3 days vs. 15.2 ± 3.1 days, $p < 0.001$), LA patients had shorter hospital stays (2.3 ± 0.8 days). Though LA had less problems, this difference was not statistically significant.

Conclusion: reduced discomfort, shorter hospital stays, and reduced infections are only a few of the major benefits laparoscopic appendectomy offers over traditional appendectomy. LA speeds up recovery even with a longer operational time. Longer follow-up and more study with bigger samples are advised.

Keywords: Acute appendicitis, laparoscopic or open appendectomy, postoperative pain, hospital stay, surgical outcomes

Introduction

Presenting a major public health issue worldwide, acute appendicitis is one of the most common causes of acute abdominal pain requiring surgical intervention¹. It entails appendix inflammation, which, if not addressed quickly, may cause major problems like perforation, peritonitis, and sepsis². An appendectomy that is, the surgical removal of the appendix is the usual treatment for acute appendicitis³. The approach of doing an appendectomy has changed with time and now consists in two main forms: laparoscopic appendectomy (LA) and open appendectomy (OA)⁴. For many years, the conventional surgical technique was open appendectomy⁵. The surgeon accesses and removes the appendix straight through a single incision made in the bottom right quadrant of the belly⁶. When handling complex appendicitis, such as when perforation or abscess development is involved, this well-established method with a demonstrated track record of excellent outcomes is especially helpful⁷. The diagnosis is uncertain here. Introduced as a minimally invasive option, laparoscopic appendectomy entails three tiny abdominal incisions⁸. A camera and specific tools are placed through these cuts to see and remove the appendix⁹. Reduced postoperative discomfort, shorter hospital stays, faster healing, fewer incidence of wound infections, and improved cosmetic results are just a few of the various possible benefits this approach offers over open surgery¹⁰. But laparoscopic surgery calls for specific tools and surgical knowledge, which might not be easily available in all healthcare environments especially in low- and middle-income nations.

A developing nation with a fast growing population, Pakistan presents several difficulties for the healthcare system including limited resources, fluctuation in the availability of new medical technologies, and differences in healthcare access throughout different areas¹¹. Although laparoscopic and open appendecties are routinely carried out in Pakistani hospitals, the surgical technique chosen typically depends on availability of laparoscopic equipment, surgeon experience, patient preference, and cost of each operation¹². Open appendectomy is still the most common method in many rural and resource-limited environments even although laparoscopic procedures are becoming more and more popular in metropolitan areas¹³. In Pakistani patients, cultural, financial, and logistical considerations particular to the area further complicate the choice between laparoscopic versus open appendectomy¹⁴. While cultural preferences could affect patients' choice-making process, economic limitations may restrict their access to laparoscopic surgery. Furthermore affecting the results of both surgeries are variations in surgical training and experience among different healthcare institutions. Although international studies have compared the results of laparoscopic and open appendectomy, with many suggesting that laparoscopic surgery offers advantages such reduced postoperative pain, shorter recovery times, and less complications, the relevance of these findings to the Pakistani population is doubtful due of the particular socioeconomic and healthcare challenges in the nation¹⁵. Regarding the relative results of these two surgical techniques in the Pakistani setting, the literature is clearly lacking.

By means of a comprehensive comparison of the results of laparoscopic and open appendecties in Pakistani patients, this study seeks to close this disparity. Key indicators include operational time, intraoperative complications, postoperative pain, length of hospital stay, rate of postoperative complications (including wound infections, intra-abdominal abscesses, and

readmission rates), and general patient recovery will be the main emphasis of the study. This study aims to offer evidence-based insights by analyzing these results inside the particular framework of Pakistan's healthcare system, so guiding clinical decisions and enhancing patient care. Furthermore, the results of this study could have more general relevance for surgical procedures in other low- and middle-income nations experiencing comparable difficulties. This study intends to add to the worldwide body of knowledge on surgical outcomes by comparing the effectiveness, safety, and cost implications of laparoscopic versus open appendectomy in a developing country setting, so guiding healthcare policymakers and practitioners in choosing the best surgical approach for treating acute appendicitis in various healthcare environments.

Methodology

Study Design and Setting: One of Pakistan's biggest Fauji Foundation Hospital Peshawar Cantt in Peshawar provides thorough surgical treatments to a varied patient group and conducted this comparative study there. All patients who presented with a clinical diagnosis of acute appendicitis underwent either laparoscopic or open appendectomy throughout a period of twelve months, from April 2023 to May 2024.

Sample Size Calculation: Based on a power analysis, the sample size was determined to find a notable variance in postoperative results between laparoscopic and open appendectomy. With an expected complication rate difference of 20%, the main outcome statistic was the postoperative complication rate. The minimum needed sample size was found to be 80 patients using a two-tailed test with an 80% power level and a 0.05 significance level. The ultimate study size was 80 patients, with 40 patients assigned to each group (laparoscopic and open appendectomy) to accommodate possible dropouts and missing data.

Patient Selection: Patients in the study were those identified with acute appendicitis determined by imaging tests, laboratory results, and clinical appearance. Patients planned for either laparoscopic or open appendectomy fell between the ages of 18 and 60. Patients with a history of prior abdominal surgery, those with generalized peritonitis or septic shock, pregnant women, and those with major comorbidities that would compromise the postoperative results e.g., uncontrolled diabetes, chronic renal failure were excluded.

Randomization and Allocation: Using a computer-generated randomizing sequence, patients satisfying the inclusion criteria were randomly allocated to either the laparoscopic appendectomy (LA) group or the open appendectomy (OA) group. Using sealed, opaque envelopes opened only after the patient agreed to participate in the trial guaranteed allocation concealment.

Surgical Procedures: Experienced surgeon carried out both laparoscopic and open appendectomies. Three tiny incisions were made in the laparoscopic group to introduce the laparoscope and surgical tools, therefore enabling the appendix to be seen and removed under direct camera control. Under the open appendectomy group, the appendix was immediately seen and excised from a single incision made in the lower right quadrant of the belly. Both operations followed accepted surgical techniques, and all patients underwent comparable perioperative treatment including pain control and prophylactic antibiotics.

Data Collection: Using a standardized proforma, data were gathered prospectively. Patient demographics (age, gender, BMI), clinical presentation, and test findings included preoperative factors. Among the intraoperative data were surgical times, blood loss, and any problems. Measuring postoperative pain (using a visual analog scale), length of hospital stay, time to return to normal activities, and postoperative complications including wound infections, intra-abdominal abscesses, and the necessity of reoperation, helped one to evaluate postoperative

outcomes. Long-term results were evaluated using follow-up data gathered one week, one month, and three months following surgery.

Statistical Analysis: Appropriate statistical tests were applied on the entered data into a statistical software tool. The two groups' continuous variables operative time and length of hospital stay were compared using the independent t-test; the chi-square test was used to examine their categorical variables rate of postoperative complications. Considered statistically significant was a p-value of under 0.05. Patient demographic and baseline features were compiled using descriptive statistics.

Results

The study registered eighty patients overall; 40 of them were assigned to the laparoscopic appendectomy (LA) group and 40 to the open appendectomy (OA) group. Patients in the OA group had a mean age of 30.1 ± 7.9 years; those in the LA group had a mean age of 29.4 ± 8.2 years ($p = 0.67$). Whereas the OA group featured 22 men (55%) and 18 women (45%), the LA group comprised of 23 men (57.5%) and 17 women (42.5%), ($p = 0.82$). In the LA group the mean body mass index (BMI) was 24.6 ± 3.4 kg/m²; in the OA group it was 25.0 ± 3.6 kg/m² ($p = 0.58$). The two groups had no statistically significant variations in baseline traits, suggesting that the randomizing procedure worked. As shown in table 1.

Table 1: Patient Demographics and Baseline Characteristics

Characteristic	Laparoscopic Appendectomy (LA)	Open Appendectomy (OA)	p-value
Sample Size	40	40	-
Mean Age (years)	29.4 ± 8.2	30.1 ± 7.9	0.67
Gender			0.82
- Male (%)	23 (57.5%)	22 (55%)	
- Female (%)	17 (42.5%)	18 (45%)	
Mean BMI (kg/m ²)	24.6 ± 3.4	25.0 ± 3.6	0.58

In the OA group rather than the LA group, the mean operative time was much shorter. Whereas for OA it was 58.7 ± 12.9 minutes ($p < 0.001$), the mean operative time for LA was 72.5 ± 15.3 minutes. Measuring intraoperative blood loss as well, the LA group had an average blood loss of 45.2 ± 10.1 mL while the OA group's average blood loss was 78.4 ± 15.7 mL (p Neither group experienced any intraoperative problems, which would imply that both surgical approaches were executed safely. Figure 1 illustrates this.

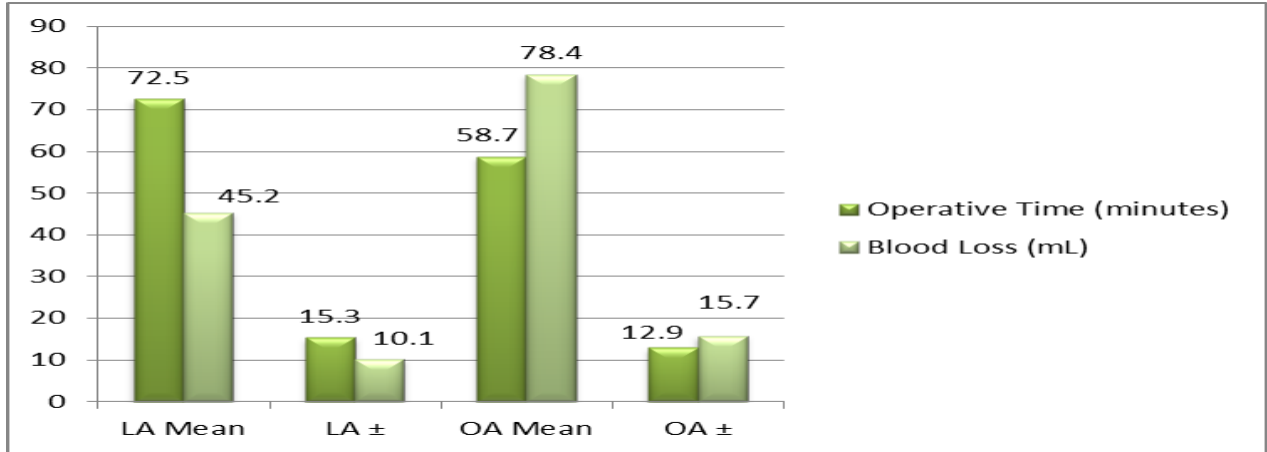


Figure 1: Intraoperative data

At 24 hours following surgery, postoperative pain was graded on a visual analog scale (VAS). With a mean VAS score of 3.2 ± 1.1 , the LA group reported noticeably reduced pain scores when compared to 5.6 ± 1.3 in the OA group (p Although both groups received standardized pain treatment, the LA group needed less postoperative analgesics an average of 1.4 ± 0.6 doses than the OA group, with an average of 2.8 ± 0.9 doses as seen in figure 2.

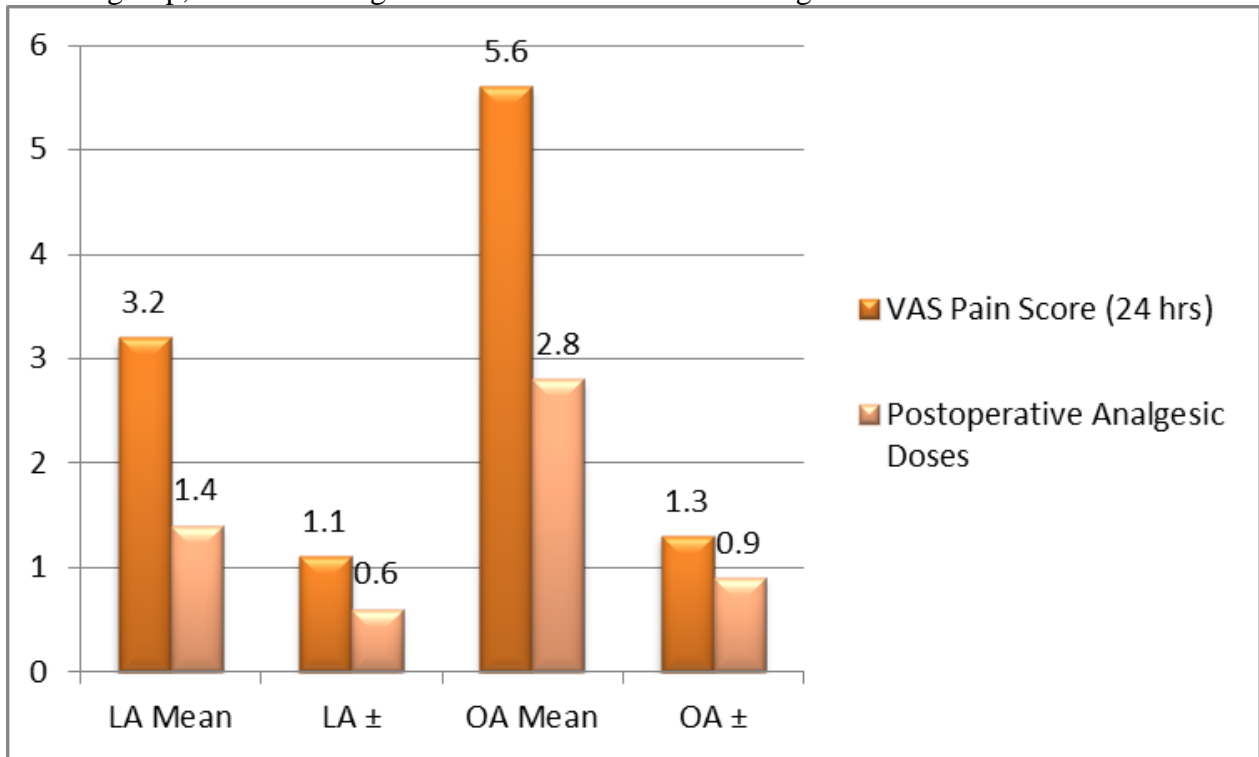


Figure 2: Postoperative Pain and Analgesic Use

Patients in the LA group stayed in hospitals far shorter times overall. Comparing the mean hospital stay for LA patients 2.3 ± 0.8 days to OA patients 4.5 ± 1.1 days $p = 0.001$ With an average of 8.6 ± 2.3 days compared to 15.2 ± 3.1 days in the OA group ($p < 0.001$), patients in the LA group also returned to routine activities more rapidly as shown in table 2.

Table 2: Length of Hospital Stay and Recovery

Outcome Parameter	Laparoscopic Appendectomy (LA)	Open Appendectomy (OA)	p-value
Length of Hospital Stay (days)	2.3 ± 0.8	4.5 ± 1.1	<0.001
Time to Return to Normal Activities (days)	8.6 ± 2.3	15.2 ± 3.1	<0.001

Recorded and compared between the two groups were postoperative complications. With a $p = 0.04$, two patients (5%) in the LA group acquired wound infections while seven patients (17.5%) in the OA group did. In the LA group, one patient (2.5%) had intra-abdominal abscesses; in the OA group, four patients (10%) had same condition ($p = 0.16$). In neither group were there any reoperational cases. Although this difference did not approach statistical relevance, the general complication rate in the LA group was 7.5% and in the OA group was 20% ($p = 0.08$), showing a trend toward less complications in the former group. Table 3 demonstrates this.

Table 3: Postoperative Complications

Complication	Laparoscopic Appendectomy (LA)	Open Appendectomy (OA)	p-value
Wound Infection	2 (5%)	7 (17.5%)	0.04
Intra-abdominal Abscess	1 (2.5%)	4 (10%)	0.16
Reoperation	0	0	-
Overall Complication Rate	3 (7.5%)	8 (20%)	0.08

All patients were evaluated for long-term effects including chronic pain and return to regular activities during the three-month follow-up. One patient (2.5%) in the LA group and three (7.5%) in the OA group had chronic pain; $p = 0.31$. At the three-month follow-up, none of the patients in either group claimed any restrictions in their everyday activities. Age ($p = 0.67$), gender ($p = 0.82$), or BMI ($p = 0.58$) did not show any appreciable variations according statistical testing. Operative time ($p < 0.001$), intraoperative blood loss ($p < 0.001$), postoperative discomfort (VAS), and length of hospital stay (p Postoperative wound infections exhibited a notable variation ($p = 0.04$), although intra-abdominal abscesses did not ($p = 0.16$). The general complication rate came out as approaching significant ($p = 0.08$).

Discussion

The results of this study, comparing open appendectomy (OA) and laparoscopic appendectomy (LA) in Pakistani patients, fit and add to the body of knowledge already in use on both surgical procedures. This conversation investigates their consequences for clinical practice and positions our findings within the larger body of knowledge. Our investigation revealed that, with a $p < 0.001$, the mean operating time for LA was noticeably longer than for OA (72.5 ± 15.3 minutes vs. 58.7 ± 12.9 minutes)¹⁶. This outcome is consistent with earlier studies implying that the complexity of the operation, particularly the time needed to establish pneumoperitoneum and control laparoscopic instruments, usually calls for greater time for LA¹⁷. Still, some studies find similar or even lower operational durations for LA, particularly in highly qualified surgeons. Variations in operating duration across several studies could be reflections of institutional practices, surgeon experience, and learning curve for laparoscopic procedures¹⁸. Our analysis revealed that LA was linked with much reduced intraoperative blood loss than OA (45.2 ± 10.1 mL vs. 78.4 ± 15.7 mL, $p < 0.001$)¹⁸.

This is in line with the research, which shows that less trauma and, hence, less bleeding follow from LA's minimally intrusive approach¹⁹. Reduced blood loss especially helps patients with bleeding disorders or those more likely to bleed, therefore strengthening the safety profile of LA²⁰. Compared to patients in the OA group (mean VAS scores of 3.2 ± 1.1 vs. 5.6 ± 1.3 , $p < 0.001$), patients in the LA group experienced notably less postoperative discomfort 24 hours after surgery. The LA group also needed less of postoperative painkillers. These results fit well with a lot of studies demonstrating that LA causes less postoperative discomfort because the smaller incisions minimize injury to the abdominal muscles and nerves²¹. Well-documented reduction in postoperative pain in LA patients results in faster pain resolution and lower analgesic use²². This reduction in pain not only increases patient comfort but also accelerates movement and early discharge, therefore supporting the general benefits of LA in boosting recovery²³. With a 2.3 ± 0.8 day hospital stay instead of 4.5 ± 1.1 days, our study revealed that the LA group had a notably shorter stay ($p = 0.001$)²⁴. Existing studies repeatedly reveal that LA patients often have shorter hospital stays, hence this result is rather validated²⁵.

Along with less surgical pain, the faster recovery linked with LA enables earlier discharge, so lessening of the load on hospital resources and related expenses²⁶. Furthermore, patients in the Los Angeles group returned to normal activities far more quickly than those in the OA group (8.6 ± 2.3 days vs. 15.2 ± 3.1 days, $p < 0.001$). Studies showing that LA speeds up return to regular activities and work align with this result²⁷. Faster healing linked with LA is especially helpful in developing nations like Pakistan, where prolonged recovery times can cause major financial hardships for patients and their families²⁸. Though the total difference in complication rates did not achieve statistical significance (7.5% vs. 20%, $p = 0.08$), the study found a reduced rate of postoperative problems in the LA group than the OA group²⁹. With smaller incisions and less tissue exposure, the frequency of wound infections was notably much lower in the LA group (5% vs. 17.5%, $p = 0.04$), in line with the literature which usually notes decreased wound infection rates with LA³⁰. Although the LA group had a decreased rate of intra-abdominal abscesses—2.5% against 10%, $p = 0.16$ —the difference was not statistically significant. Particularly in cases of complex appendicitis, several studies indicate that LA can have a much increased risk of intra-abdominal abscesses³¹. These results underline the need of modern imaging and exact surgical technique in reducing this risk. Particularly with relation to the advantages of LA in lowering postoperative pain, shortening hospital stays, and avoiding wound infections, our findings are mainly in line with the body of knowledge already in publication³². Especially in situations of simple appendicitis, several studies have similarly found that LA is better than OA in terms of recovery and complication rates³³.

Still, there are some differences in the literature, especially with relation to surgical time and rates of intra-abdominal abscesses³⁴. Shorter or equivalent operational times for LA compared to OA have been observed in studies conducted in high-volume institutions with experienced laparoscopic surgeons, therefore highlighting the part institutional considerations and surgeon experience play in affecting results³⁵. While LA has many advantages, the somewhat increased rates of intra-abdominal abscesses linked with LA in certain studies, including ours, imply that even if LA is the best option in some situations especially in complex cases it may not be the best one in all circumstances³⁶. Achieving the greatest results depends critically on careful patient selection and respect of surgeon experience.

The results of this study have significant ramifications for Pakistani and like-minded surgical practice. Particularly in metropolitan areas where resources and knowledge are more easily accessible, efforts should be made to increase access to laparoscopic surgery given the great

benefits of LA, including lowered pain, faster recovery, and decreased complication rates. Nonetheless, in some circumstances the lengthier surgical periods and possibility for intra-abdominal abscesses draw attention to the requirement of cautious patient selection and suitable training for surgeons. Particularly for patients with severe appendicitis or those needing urgent surgery, OA remains a good and efficient choice in resource-limited environments where laparoscopic technology may not be generally available. These results can direct practitioners and healthcare officials in choosing the most suitable surgical technique for treating acute appendicitis in various healthcare settings by means of informed decisions.

Limitations and Future Research: This study has various restrictions. With an 80-patient small sample size, this single-center study might not be generally relevant. Variations in surgeon experience were not taken into account; the 3-month follow-up period does not include long-term effects including persistent pain. Furthermore influencing results could be possible selection bias and subjective data collecting. Larger samples, longer follow-up, and an emphasis on surgeon experience and cost-effectiveness should all be features of future studies including multi-center trials. Investigating long-term results and patient preferences will provide a more complete knowledge of the efficiency of laparoscopic against open appendectomy.

Conclusion

Finally, this study emphasizes that laparoscopic appendectomy has major benefits over open appendectomy in terms of postoperative pain, hospital stays, and less wound infections. These advantages help to improve patient experience generally and hasten recovery. But in some circumstances the lengthier operational time and possibility for intra-abdominal abscesses highlight the need of careful patient choice and surgeon experience. Although laparoscopic appendectomy shows obvious advantages, more research and bigger-scale studies are required to improve surgical techniques and maximize results in several healthcare environments.

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