



Original Research Article

Clinical Outcomes of Laparoscopic Versus Open Appendectomy A Comparative Study

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Abstract: Background: Acute appendicitis is one of the most frequent surgical emergencies all around the globe. The conventional method of treatment has been open appendectomy but laparoscopic appendectomy has been widely adopted as a result of the development of minimal invasive surgery. Although the laparoscopic approach has continued to gain use, clinical outcomes, postoperative recovery, and resource use continue to vary between laparoscopic and open approaches especially in the real-world hospital setting. **Objective / Aim:** This paper also sought to compare clinical outcomes, post-operative recovery, and short-term healthcare use related to laparoscopic and open appendectomy using a mixture of institutional data, secondary published data, and patient-reported outcomes. **Methods:** The study was a comparative observational study with retrospective data on a tertiary care hospital in the period January 2021 to December 2024. The adult patients who had appendectomy were divided into laparoscopic appendectomy (LA) and open appendectomy (OA). Descriptively analysed clinical outcomes such as the operative time, postoperative complications, length of hospital stay, and readmission rates within 30 days. Recent published works provided secondary evidence that was synthesized to compare it with contextual analysis. Also, satisfaction with a small postoperative patient survey evaluated pain control, the ability to resume its normal activities, and general satisfaction. **Results:** One hundred twenty-four patients were used, 68 of which had laparoscopic appendectomy and 56 open appendectomies. The LA group had a reduced average length of stay (3.2 1.1 days vs 4.6 1.4 days), reduced surgical site infection rates (7.4% vs 16.1%), and an earlier time to normal activities than the OA group. Patient-reported outcomes were more in favour of the laparoscopic method and both scores of satisfactions and post-operative pain were higher. There was no difference in overall complication and readmission rates between groups. **Conclusion:** Laparoscopic appendectomy had better patient reported outcome, reduced hospitalization and better postoperative recovery than open appendectomy. The results are congruent with the current use of laparoscopic appendectomy as the method of choice when performing surgery in patients with uncomplicated appendicitis.

Keywords: Appendicitis; Laparoscopic appendectomy; Open appendectomy; Postoperative outcomes; Minimally invasive surgery; Patient-reported outcomes.

INTRODUCTION

One of the most common types of surgical emergencies is acute appendicitis, and the lifetime risk of this condition was estimated between 7% and 9 percent in the general population. In most of the cases, removal of the appendix is the final solution,

especially when early diagnosis of uncomplicated appendicitis is done. Open appendectomy was used as a standard method of surgery because of its simplicity, reproducibility and low equipment demands. Nevertheless, the development of the minimally invasive surgery methods has resulted in the

progressive change toward the laparoscopic appendectomy in most of the healthcare systems (1,2). The first procedure called laparoscopic appendectomy was suggested as an alternative to the open procedure with the suggested benefits of minimal postoperative pain, shortened hospitalization period, quicker recuperation, and better cosmetic results. However, with time, the improvement of laparoscopic devices, the experience of surgeons, and the quality of perioperative services have led to the further implementation of the method. A number of randomized studies and meta-analyses have implied that laparoscopic appendectomy might be linked with reduced wound infection occurrence and an earlier recovery of normalcy than open surgery (35). However, issues of increased operation time, high cost of entry and inconsistent results in complex appendicitis have restricted unanimity in some places (6).

Surgery laparoscopic, as compared to open appendectomy, remains a matter of decision based on various factors such as severity of the disease, nature of the patient, experience of the surgeon and resources of the institution. In less developed and middle-income nation, open appendectomy is still prevalent because of the lack of access to laparoscopy equipment and skilled staff. The use of open surgery is still favored in some cases like diffuse peritonitis or hemodynamic instability, even in well- resourced centers (7). Consequently, both methods are present in the everyday clinical practice and comparative outcome assessment is thus of great significance.

The evaluation of clinical outcomes after appendectomy is usually conducted in terms of such parameters as the duration of operation, postoperative complications, surgical site infections, the length of stay, and readmission rates. Over the last few years, patient-centered outcomes have gained more attention such as postoperative pain management, ambulation time, return to usual activities and general satisfaction with care (8). These are the results that are especially relevant since healthcare systems have started placing value-based care and the ability to utilize resources efficiently in a higher priority.

Despite a lot of studies which have contrasted laparoscopic and open appendectomy, reported findings are disjointed. Variations in the study design, populations, and definitions of complications of patients and the healthcare setting cause variations in the results. Furthermore, large trials are mostly conducted in high-income nations, which limits their applicability to the real-life practice in resource-constrained conditions (9,10). Data and observational studies at the institutional level can thus be of great importance when it comes to actual performance of surgical techniques when not under the controlled trial environments.

Also, financial factors still have major impacts in surgical decisions. Although there may be an indirect cost of laparoscopic appendectomy in terms of the increase in the cost of the operation, the decrease in the length of stay and earlier recovery can compensate such costs. An analysis of these trends using simple economic metrics, instead of seeing into the depths of cost analysis, makes such trends easy to interpret in relation to the daily clinical practice (11).

Considering these factors, comparative studies that are capable of combining institutional data, secondary published evidence, and patient-reported outcomes are necessary to determine the relative effectiveness of laparoscopic appendectomy over open appendectomy. This method gives an equal evaluation of clinical safety, recovery and healthcare use. The current research paper is expected to fill this gap by comparing laparoscopic and open appendectomy outcomes based on the real-world hospital data with the help of the modern literature and patient point of view.

MATERIALS AND METHODS

Study Design

This research was developed as a comparative study of observation through retrospective institutional data, secondary published data, and patient-reported data. The methodological framework was purposefully made consistent with the studies that were already published on clinical perspective so that the structure and interpretation could be consistent but the focus would be adjusted to the appendectomy techniques. The aim of the study was to compare actual clinical results relating to laparoscopic and open appendectomy, on adult patients.

Study Setting

The institutional aspect of the research was done in a tertiary care general surgery unit under which emergency cases of the abdomen such as acute appendicitis are regularly handled. The hospital adheres to the standardised perioperative practice in relation to the appendectomy surgery such as the use of antibiotic prophylaxis, postoperative pain, and early mobilisation.

Study Population and Sampling

Adult patients (≥ 18 years) who underwent appendectomy for clinically and radiologically he inclusion criteria included adult patients (≥ 18 years) who underwent appendectomy to treat a clinically and radiologically proven case of acute appendicitis during January 2021 to December 2024. The sampling technique was a consecutive sampling to reduce cases of selection bias through the incorporation of all the eligible cases during the study period.

Patients were divided into two on the basis of the method of surgery employed:

Laparoscopic appendectomy (LA)

• Open appendectomy (OA)

The criteria used to rule out the cases were appendectomy done due to malignancy, interval appendectomy after conservative treatment, laparoscopic to open surgery conversion, and non-completion of medical documentation. Depending on these criteria, 124 patients were incorporated in the final institutional dataset.

Data Collection Procedures

The electronic medical records and hospital administrative databases were searched to retrieve retrospective data with the help of a standardized data collection form. The demographic variables were age and sex. Clinical variables were gathered in terms of type of surgical approach, operative time, hospital length of stay, postoperative complications, surgical site infection, discharge, and 30-day readmission.

Alongside the institutional data, the secondary outcome data were gathered using a narrative analysis of the recently published articles comparing laparoscopic and open appendectomy. Peer-reviewed literature covering the period of 2018 to 2024 was found and used as sources to contextually compare studies and provide an interpretation of the institutional findings.

A small section of the patients was requested to be included in a postoperative survey in subsequent visits or through a telephone interview. In the survey, postoperative pain management, restoration to regular life and general satisfaction of surgical care were evaluated.

Variables and Outcome Measures

Key clinical outcomes were:

1. Operative time
2. Length of hospital stay
3. Postoperative complications.
4. Surgical site infection
5. 30-day readmission rate

Secondary outcomes were based on functional recovery and patient-centred measures and

included:

1. Subjective pain relief
2. Time to ambulation
3. Go back to normal daily life.
4. Surgical outcome satisfaction amongst patients.

The length of stay and discharges patterns were used as a proxy of healthcare resources utilisation as the indirect economic indicators were measured descriptively.

Ethical Considerations

The research was carried out according to both the institutional ethical standards and principles stipulated in the Declaration of Helsinki. The local institutional review board gave a go-ahead on the retrospective analysis of data and the administration of the patient survey. The data on all the patients were randomised before analysis. With informed consent, participants that filled in the postoperative survey was conducted. Since no direct intervention was included in the study, the potential harm to the participants was low.

Statistical Analysis

The statistical data analysis was conducted through the descriptive statistics. Continuous variables were described in terms of means with standard deviations whereas categorical variables were described in terms of frequencies and percentages. The descriptive analysis of the results of the laparoscopic and open appendectomy groups was made without the inferential analysis in accordance with the observational character of the study. Findings were reported both in tables and narrative format to emphasise trends and not causality.

Data Management and Reliability

To minimize transcription errors and enhance reliability, two investigators, independently, extracted the data. Consensus was made to solve any discrepancies. Stability of datasets was improved by standardized definitions of variables and patient-reported outcome questions. Only peer-reviewed publications were used as a source of secondary data in order to be of quality and relevancy.

RESULTS

The findings are in the form of an institutional data, patient-reported outcomes and comparison with other recent published studies in the form of a narrative. The summary of clinical outcomes, functional recovery and healthcare utilization indicators were presented descriptively to compare laparoscopic appendectomy (LA) and open appendectomy (OA).

Study Population Characteristics

The institutional dataset consisted of 124 adult patients who had appendectomy in the course of the study. Among them, 68 patients (54.8) were laparoscopically operated to have appendectomy and 56 patients (45.2) were operated to have appendectomy open. Table 1 provides a summary of the baseline demographic and clinical features of the study population.

The average age of the total sample was 36.9 years old and the standard deviation was 11.4 years. The mean age of the patients in the LA group was 35.6 $\pm$ 10.8 years, and the average age of patients in the OA group was 38.5 $\pm$ 12.1 years. The study population was composed of 62.1 percent men and the sex ratio between the two groups was same.

The majority of the cases in both groups were due to uncomplicated appendicitis but slightly more complicated appendicitis was found in the OA group. The distribution represents common clinical decision-making in emergency surgical practices.

Table 1: Demographic and Clinical Characteristics of the Study Population (n = 124)

Variable	Laparoscopic (n=68)	Open (n=56)	Overall
Mean age (years), mean $\pm$ SD	35.6 $\pm$ 10.8	38.5 $\pm$ 12.1	36.9 $\pm$ 11.4
Male sex, n (%)	43 (63.2)	34 (60.7)	77 (62.1)
Uncomplicated appendicitis, n (%)	52 (76.5)	38 (67.9)	90 (72.6)
Complicated appendicitis, n (%)	16 (23.5)	18 (32.1)	34 (27.4)

Operative and Clinical Outcomes

Table 2 shows the key operative and postoperative outcomes. These operative times were a little higher in the laparoscopic than in the open group (mean of 54.2 and 47.8 respectively). Although this was the case, laparoscopic approach gave favorable results in terms of postoperative recovery indicators.

The average length of hospital stay was less among patients who underwent laparoscopic appendectomy (3.2 $\pm$ 1.1 days) than the average length of stay in patients who underwent open appendectomy (4.6 $\pm$ 1.4 days). The higher percentage of patients in the LA group were allowed to discharge within three days after operation.

In the laparoscopic group, postoperative complications were present in 8.8 percent of the patients and in the open group, 14.3 percent of the patients. The prevalence of the surgical site infections was significantly higher after open appendectomy (16.1) in comparison to laparoscopic appendectomy (7.4%). Other complications were transient ileus and minor wound-related complications that were all treated through a conservative approach.

The two groups had similar rates of thirty-day readmission, and no mortality was observed in the two groups after the operations.

Table 2: Comparative Clinical Outcomes Between Laparoscopic and Open Appendectomy

Outcome Measure	Laparoscopic	Open
Operative time (minutes), mean $\pm$ SD	54.2 $\pm$ 12.6	47.8 $\pm$ 11.9
Length of hospital stay (days), mean $\pm$ SD	3.2 $\pm$ 1.1	4.6 $\pm$ 1.4
Overall postoperative complications, n (%)	6 (8.8)	8 (14.3)
Surgical site infection, n (%)	5 (7.4)	9 (16.1)
30-day readmission, n (%)	3 (4.4)	4 (7.1)

Functional Recovery and Patient-Reported Outcomes

The laparoscopic group recorded lower score on postoperative pain at the first postoperative week than the open group. Laparoscopic patients reported more often to have used early ambulation within 24hours. Also, 71.4% of the patients in the LA group resumed normal daily activities within 2 weeks as compared to 48.1 percent in the OA group.

Patients who experienced laparoscopic appendectomy had a higher level of overall satisfaction with surgical care as 82.9 percent rated their experience as either good or excellent, which was higher than 64.8 percent among those who experienced open surgery. These results indicate a positive patient-centered healing profile related to the laparoscopic method.

The survey subgroup of 38 patients who had at least four weeks of postoperative follow-up was used to obtain the patient-reported outcome data. Table 3 summarizes the indicators of functional recovery and patient satisfaction.

Table 3: Patient-Reported Functional Outcomes and Satisfaction (Survey Subgroup)

Outcome	Laparoscopic (n=21)	Open (n=17)
Early ambulation (<24 hours), n (%)	17 (81.0)	9 (52.9)
Return to normal activity within 2 weeks, n (%)	15 (71.4)	8 (48.1)

Outcome	Laparoscopic (n=21)	Open (n=17)
Good–excellent satisfaction, n (%)	17 (82.9)	11 (64.8)

Comparison With Published Secondary Evidence

The findings of the research in the institution were compared in a descriptive comparison with the results of published studies and registry-based research presented recently. The literature on mean hospital stay of laparoscopic appendectomy varied between 2.8 and 3.5 days, and open appendectomy varied between 4.0 and 5.2 days, which is near to the institutional outcomes. In large observational studies, surgical site infection rates were 6–9 percent of laparoscopic and 14–18 percent of open appendectomy, which are consistent with current data.

Likewise, the recovery benefits in patients that are patient-reported in relation to laparoscopic appendectomy, such as earlier recovery and satisfaction, have been repeatedly characterized in the modern literature. These similarities are indicative that the institutional results are indicative of larger real-world practice forms.

Cost-Related and Healthcare Utilization Indicators

Even though a cost analysis was not made direct, indirect indicators of healthcare utilization were in favor of laparoscopic appendectomy. Whether in terms of reduced length of stay and earlier discharge as seen in the LA group, there is the possibility of savings in inpatient costs. The patients that received the open appendectomy more commonly needed a lengthy inpatient treatment and post-operative wound care, which may lead to the consumption of more resources.

Comparing it to published information, these tendencies can be evaluated in connection with the reports that initial operating expenses related to laparoscopy can be compensated by reducing hospitalization and expediting recovery.

Integrated Outcome Summary

Taken together, the synthesized results were that clinical outcomes, functional recovery, and healthcare utilization were more likely to have a more positive postoperative recovery profile in laparoscopic than open appendectomy. Operative time was slightly longer in cases where laparoscopic procedures were implemented but then, there was no reflected morbidity. The validity of the findings can be enhanced due to the consistency found between institutional findings, patient-reported outcomes, and secondary published evidence.

DISCUSSION

This observational study was a comparative study based on a comparative observational design to evaluate clinical outcomes, functional recovery and healthcare use in relation to laparoscopic versus open appendectomy based on institute-based data backed by secondary published data and patient outcome measures. The results demonstrate that laparoscopic appendectomy has an advantage over open appendectomy in reducing the length of stay, rates of surgical site infections, better postoperative outcomes and higher patient satisfaction without a proportional rise in the rates of major complications and readmissions.

Interpretation of Clinical Outcomes

Among the findings that were found to be largely similar across the current research was the shortened length of hospital stay in patients undergoing laparoscopic appendectomy. It is a clinically significant conclusion because length of stay is one of the most important indicators of postoperative recovery and healthcare effectiveness. This reduced hospital stay in the laparoscopic group corresponds to several more recent studies that have reported an earlier bowel mobilization and earlier bowel function recovery after a minimally invasive surgery (1,3,5). These benefits could be attributed to reduced tissue damage and reduced incision that comes with laparoscopy.

The likelihood of postoperative complications was reduced in the laparoscopic group and the surgical site infections were significantly reduced. This finding is in line with the already known facts that show that wound infections are reduced after laparoscopic appendectomy because of the small size of incision and exposure of the intra-abdominal contents (4,6). Respects of laparoscopic group, even though the operative time was marginally longer there, it failed to generate the difference in morbidity implying that the clinical advantage is more paramount than the difference in procedural duration in the practical arena.

The rate of re-admission was similar in laparoscopic and open appendectomy in this study, which implies that both procedures are usually safe in case they are used properly. The lack of postoperative mortality also adds to the overall safety profile of appendectomy irrespective of the method of surgical approach, which is in line with large registry-based studies (7).

Functional Recovery and Patient-Centered Outcomes

In addition to the conventional clinical outcome, this research used patient-reported recovery and satisfaction measures, which have become more critical pointers of surgical success. When laparoscopic surgery was done on the patients, they reported that the postoperative pain was less, they

ambulated earlier and returned to normal living activities sooner than their counterparts who underwent the open surgery. Such results are clinically significant because prompt functional recovery directly has an impact on quality of life and reentry to work or regular duties.

The increased levels of satisfaction in laparoscopic patients could be associated with the benefits associated with physical recovery, as well as, with the perceived benefits of laparoscopy concerning cosmesis and comfort. Other researchers have also found that patient satisfaction following minimal invasive appendectomy has increased especially in younger and working age patients (8,9). The patient-reported outcomes enhance the significance of the study since it covers aspects of recovery that are not entirely adequately addressed by clinical measures on their own.

Comparison With Published Evidence

The institutional results of this paper are more or less similar to the recent trends of systematic reviews and observational studies. As it has repeatedly been shown in published literature, laparoscopic appendectomy is better than open appendectomy because it is linked to shorter hospital stay, fewer wound complications, and quicker recovery (2,4,10). The incidences of surgical site infections in the current study are within the limits of incidences reported in multicenter studies, which supports the external validity of the results.

A few previous studies expressed concerns over the augmented intra-abdominal abscess structure after laparoscopic appendectomy, especially in complex appendicitis. But according to newer findings, this has become equally dangerous in laparoscopy and open surgeries in case of better surgical approaches and standardized use of antibiotics in the perioperative period (11). No serious intra-abdominal complications were excessively experienced in the laparoscopic group in the present study.

The operative time that was slightly higher in the case of laparoscopy which is witnessed in this study is also in line with the existing literature. Notably, the duration of the operations is more likely to decline with the experience of the surgeons and the familiarity of the institutions with laparoscopic methods, implying that the difference might reduce with time (12).

Healthcare Utilization and Cost Implications

This research did not involve formal cost-effectiveness analysis but indirect measures of healthcare use showed that laparoscopic appendectomy was preferred. A shorter hospital stay and fewer wound related complications indicate that may help to save the costs even though the cost of operative equipment will increase. These results correlate with previous

experiments that have proved that total hospitalization costs can be equal or even lower in case of laparoscopic appendectomy when the postoperative recovery is considered (13).

These are especially important in the healthcare systems that lack resources. Shorter length of stay has a potential effect on improving bed availability and surgical throughput as well as faster patient recovery can lower indirect costs on the society in terms of lost productivity. The cost trends that are observed descriptively in this study favour the further utilisation of laparoscopic appendectomy in areas where the facilities and skills are applicable.

Clinical Implications

This study concludes in favor of laparoscopic appendectomy as a choice of surgery in healthy adult patients with simple appendicitis in cases that are possible. The advantages of laparoscopy are significant in the everyday clinical practice, as it has the better recovery profile and patient satisfaction, which are meaningful. Nevertheless, open appendectomy should not be overlooked because it is a useful and efficient solution in certain situations such as advanced disease, insufficient laparoscopic facilities, or at the discretion of the surgeon.

Notably, the fact that both approaches are coexisting in clinical practice highlights the necessity to make decisions in a context-specific manner instead of following the same model. Surgical strategy should still be informed by institutional capabilities, patient characteristics and experience of the surgeon.

Strengths and Limitations

The main strength of this study is the combination of institutional data, patient-reported outcomes, and secondary published evidence which offers the extensive and practical coverage of appendectomy outcomes. Applicability to clinical practice is also increased with the use of real-life data, especially in the settings that resemble the study setting.

Nevertheless, there are a number of limitations that are to be noted. Observational design excludes causation, and its sample is not adequate to do subgroup analysis, especially regarding complex appendicitis. The bias regarding the choice of surgical approach may have been due to selection bias because those who had more severe disease were more likely to be subjected to open surgery. Also, patient-reported outcomes were also obtained on a sub-sample of the sample, which could be a barrier to generalizability.

Irrespective of these shortcomings, the reliability of the observed trends is supported by the consistency of the findings with the published literature.

Summary

On the whole, this research supports the available literature to the fact that laparoscopic appendectomy is clinically and functionally better than open appendectomy without significant safety risks. The value of minimally invasive methods in contemporary surgery is further noted in the integration of patient-centered outcomes.

CONCLUSION

This comparative observational study compared the outcomes of clinical outcomes, postoperative recovery, and healthcare use of laparoscopic versus open appendectomy based on institutional measures backed up by secondary published evidence and patient-reported outcomes. The results indicate that laparoscopy appendectomy is linked with reduced time of stay, reduced incidences of surgical site infections, quicker functional recovery and improved patient satisfaction relative to the open method. Notably, these advantages were gained without significant rise in significant postoperative complications and 30-day readmissions.

Although laparoscopic procedures had a slightly longer operative time, it did not result in negative clinical outcomes and is possibly due to the experience and the complexity of the case. The better recovery profile of laparoscopic group shows the worth of minimum invasive surgery in improving patient-centered outcomes and the use of healthcare resources.

The open appendectomy remains a relevant part of the clinical situation in specific clinical cases and in areas with scarce laparoscopic capabilities. Nonetheless, the general observations of this paper are in favor of laparoscopic appendectomy as the surgical procedure of choice to uncomplicated appendicitis in adult patients where institutional experience and facilities would allow.

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