

## Comparison of the Laparoscopic and open Methods for Appendectomy Clinical Outcomes

Mahendra K Faliya

Assistant Professor, Department of General Surgery, Gujarat Adani Institute of Medical Science, India

Received: 18-01-2022 / Revised: 20-02-2022 / Accepted: 10-03-2022

Corresponding author: Dr Mahendra K Faliya

Conflict of interest: Nil

### Abstract

**Background and Aim:** The most frequent surgical procedure carried out during emergency surgery is an appendectomy. Both open (OA) and laparoscopic (LA) procedures are still used to perform appendectomy due to a lack of agreement regarding the best procedure. The goal of the current study is to assess the benefits and drawbacks of two surgical approaches, namely open and laparoscopic appendectomy, for this most prevalent abdominal emergency.

**Material and Methods:** This observational study was conducted over the course of two years using data from patients who underwent open or laparoscopic appendectomy procedures for acute appendicitis. Patients undergoing open and laparoscopic appendectomy procedures had their surgical timeframes, conversion rates, complication rates, and length of hospital stay compared.

**Results:** Finally, the study included 150 patients who underwent appendectomy within the designated study period. Of these, 50 (33.33%) underwent laparoscopic appendectomy, and 100 (66.66%) underwent open appendectomy. Laparoscopic surgery took longer to complete and required a longer hospital stay than open surgery, but both treatments had about the same rate of complications. In comparison to the open group, the laparoscopic group had higher incidence of intra-abdominal collection.

**Conclusion:** According to the current study, a skilled surgeon can easily complete a laparoscopic appendectomy. Laparoscopic appendectomy was found to have a lower overall complication rate and shorter hospital stay, but surgical duration was slightly longer. Although there was a modest increase in intraabdominal collection among the laparoscopic group, this did not significantly affect the operative outcome. Although there is no agreement on the optimum strategy, both techniques are still actively used, leaving the decision to the patient and surgeon's preferences.

**Keywords:** Appendectomy, Complication Rate, Intraabdominal Collection, Laparoscopic Appendectomy.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Appendicitis is the most typical surgical emergency seen in any surgical unit. The most frequent reason for appendectomy is this one. Acute appendicitis affects 7–10% of the general population, with the second and

third decades of life seeing the highest incidence [1]. Nevertheless, it has been noted that open appendectomy (OA) has a reported morbidity rate of 11% and a death rate of 0.3% [2].

Since its debut by McBurney in 1894, appendectomy has been demonstrated to be the gold standard of care for the treatment of acute appendicitis [3]. Studies from the past few years have shown that LA is superior to OA in randomised trials [4,5]. In comparison to OA procedures, this technique has been found to have advantages in terms of lower wound infections, less instances of vomiting, less pain, as well as shorter hospital stays and quicker recovery times [6,7]. In contrast, it was also noted that the LA group's operating time was longer and was linked to a greater cost [7]. Also, some of the research fell short of demonstrating that LA was more effective than OA [8,9]. Infection at the surgery site is the most frequent complication associated with OA (SSI).

This is the most frequent problem that extends hospital stays and drives up costs. It was discovered that the likelihood of SSI is higher in OA, and this greatly lengthens the hospital stay [10].

Many benefits of laparoscopic surgery include a quick recovery, reduced pain at the surgical site, and a shorter hospital stay [11]. Laparoscopic appendectomy offers significant benefits in cases of severe appendicitis, including a lower risk of wound infection and greater peritoneal cavity visibility [12].

While laparoscopic cholecystectomy has long since supplanted open surgery as the gold standard way for conducting the procedure, laparoscopic appendectomy has not yet attained the same level of acceptance [5]. On the other hand, a laparoscopic appendectomy takes more time to perform and is more expensive for the hospital [10]. Several comparative studies have backed the laparoscopic method as an alternative to open appendectomy [14]. Some trials fell short of proving that laparoscopic appendectomy is clearly superior to open appendectomy [15,16]. There is little agreement on whether

laparoscopy should be regularly performed for all patients with suspected acute appendicitis or only in a small subset of individuals.

The aim of the current study is to assess the benefits and drawbacks of two surgical approaches, namely open and laparoscopic appendectomy, for this most prevalent abdominal emergency.

### **Material and Methods**

This observational study was conducted over the course of two years using data from patients who underwent open or laparoscopic appendectomy procedures for acute appendicitis. The study included all patients of either sex with a diagnosis of acute appendicitis who had appendectomy throughout this time using either technique. Patients who did not have an established clinical diagnosis of acute appendicitis, had a palpable mass in the right lower quadrant that suggested an appendiceal abscess, did not provide consent, or both were excluded from the trial. The institutional ethics committee's approval was sought before the study could commence. Patients received information about the study's methodology at the outset, and their informed permission was obtained. The operations, as well as the risks and advantages attached to them, were also explained to the patients. 150 patients who met the inclusion criteria, together with their clinical information and hospital expenses, were examined. The patients were divided into two groups: open appendectomy (OA) group and laparoscopic appendectomy (LA) group. The right iliac fossa or periumbilical discomfort, nausea, and vomiting were used in the clinical history and physical examination to make the diagnosis (tenderness or guarding in right iliac fossa). Imaging tests such as abdominal ultrasonography or CT were carried out on patients in cases when a clinical diagnosis could not be made. The study excluded open

appendectomies done by a midline incision due to concomitant peritonitis or uncertain diagnoses. Those who had any other pathology recognised prior to surgery than acute appendicitis were also excluded. Acute appendicitis severity was categorised based on the disease severity score (Table 1). The cases were examined in terms of age, gender, acute appendicitis severity, operating time, complications, and length of hospital stay. Also, the length of surgical exposure was contrasted. Gridiron/Lanz incisions were used to do open appendectomies. Three ports—one 10 mm port above the umbilicus, one 5 mm port in the midline slightly above the pubis, and a third 10 mm port in the left iliac fossa—were used to perform the laparoscopic appendectomy. Remaining procedure remain same which includes performing appendectomy after sealing of appendicular artery and retrieval of appendix via endo bag in laparoscopic approach.

### Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

### Results

Finally, the study included 150 patients who underwent appendectomy within the designated study period. Of these, 50 (33.33%) underwent laparoscopic appendectomy, and 100 (66.66%) underwent open appendectomy. The patient groups were contrasted in terms of appendicitis severity, age, and gender (Table 2). The average length of the procedure was 28.98 minutes for an open appendectomy and 37.42 minutes for a laparoscopic procedure (Table 3). Due to diffuse peritonitis, three patients in the laparoscopic group underwent an open procedure while six patients undergoing an open appendectomy underwent a midline approach. The average length of stay in the hospital was 3.010.35 days for open appendectomy patients and 2.10.4 days for laparoscopic patients. Infection of the wound was the most frequent complication observed in 4 (7%) patients after open surgery. Post-operative collections occurred in three (3%) patients. In contrast, 5 (10%) of the patients who underwent laparoscopic surgery experienced postoperative problems. Three patients (6%) had an infection at the port site, and two (4%) had abdominal collections.

Grade 1: Inflamed, grade 2: Gangrenous, grade 3: Perforated with localized free fluid, grade 4: Perforated with regional abscess and grade 5: Perforated with diffuse peritonitis.

**Table 1: Disease severity score**

Grades	LAP (%)	Open (%)
1	12 (24)	23 (23)
2	10 (20)	15 (15)
3	20 (40)	35 (35)
4	6 (12)	16 (16)
5	2 (4)	11 (11)

**Table 2: Patient characteristics**

Variables	LAP (%)	Open (%)
Age	26.1±3.04	28.5±6.15
Male	21 (42)	52 (52)
female	29 (58)	48 (48)

**Table 3: Comparison between laparoscopic appendectomy and open appendectomy**

Variables	LAP (%)	Open (%)	P value
Operative time (min)	37.42±7.998	28.98±7.45	0.01*
Hospital stays (day)	2.1±0.4	3.01±0.35	0.03*
Conversion	3 (6)	6 (6)	0.001*
Complications	5 (10)	3 (3)	0.001*
Intra-abdominal collection	3 (6)	11 (11)	0.04

Indicates statistically significance at  $p \leq 0.05$

## Discussion

Many long-accepted surgical concepts have been reexamined as a result of laparoscopic surgery's success in treating gallbladder disorders and many other conditions. One of the most frequent medical disorders requiring urgent treatment is acute appendicitis. In the past 20 years, laparoscopic surgery has made significant advances in surgery. Metaanalyses have demonstrated that, at the expense of a longer operating time, laparoscopic appendectomy is safe and leads to a quicker return to regular activities with fewer wound problems [17,18]. Also, there is a widespread belief that laparoscopic appendectomy offers very little benefits and might not be worth the difficulty [19].

The most frequent intra-abdominal ailment needing emergency surgery is acute appendicitis [20]. Any patient who presents with an acute abdomen should be evaluated for the risk of appendicitis, and a specific preoperative diagnosis is still difficult to make [21,22]. Open appendectomy is still the standard procedure even though laparoscopic appendectomy was first introduced more than 20 years ago (by gynaecologist Semm in 1983). According to some writers, emergency laparoscopy is a promising procedure for treating abdominal emergencies since it can reduce expenses and invasiveness while maximising results and patient comfort [23,24]. Laparoscopic appendectomy is safe and leads to a quicker return to regular activities with fewer wound complications, according to research [10,11,25-27].

According to the literature, laparoscopic appendectomy has a higher complication risk and higher cost than the traditional open treatment [28]. While optimal abdominal cavity exploration, a shorter hospital stay, and less post-operative discomfort are advantages of laparoscopic appendectomy, these benefits are consistent with our study. The differences in both methodologies' techniques could change the costs and complexity of the results [29]. All stages of acute appendicitis severity, including diffuse peritonitis, can be treated using a three ports laparoscopic approach to appendectomy [30]. In addition, using a handcrafted endo loop is less expensive than using a linear stapler [31]. Compared to an open incision, a laparoscopic method provides the best view of the surgical field. Also, if an abdominal incision is large and polluted, the risk of complications is much diminished with a laparoscopic procedure [32]. The laparoscopic technique had a lower rate of wound-related problems than the open approach, according to our study. Moreover, postoperative intra-abdominal collection or abscess formation was noted in 2 (5%) of the patients who underwent laparoscopic surgery, which was more than the 2 (2.5%) patients who underwent open appendectomy, as noted in the study by Salmone *et al* [33]. Several studies found no differences between open and laparoscopic appendectomy in terms of speedy recovery and ability to carry out daily tasks. Because "activity" is defined and categorised differently in these research,

this subject is still up for discussion. 33-37. Several studies have shown that laparoscopic appendectomy has a lower incidence of complications than open appendectomy [10-17]. These research and ours both support each other.

It is encouraging to see that other, more recent trials in which a different subset of patients underwent laparoscopic appendectomy support our findings. These investigations came to the conclusions that laparoscopy should be routinely utilized for all young females presenting with right iliac fossa pain, that laparoscopic appendectomy is safe for children with advanced appendicitis, and that it is not linked to an increase in morbidity in older individuals [30-31]. Our study's limitations included the fact that we did not gather data on body mass index, making it impossible to assess the effectiveness of laparoscopic surgery in obese individuals

### Conclusion

Laparoscopic appendectomy is an advanced and practical method for the operational treatment of acute appendicitis. According to the current study, a skilled surgeon can easily complete a laparoscopic appendectomy. Laparoscopic appendectomy was found to have a lower overall complication rate and shorter hospital stay, but surgical duration was slightly longer. Although there was a modest increase in intraabdominal collection among the laparoscopic group, this did not significantly affect the operative outcome. Although there is no agreement on the optimal strategy, both open and laparoscopic appendectomy are still actively performed, leaving the decision to the surgeon's and the patients' personal preferences. Laparoscopic appendectomy might become the norm in the future for people with appendicitis and unexplained stomach pain.

### References

1. Kurtz RJ, Heimann TM. Comparison of open and laparoscopic treatment of acute appendicitis. *Am J Surg.* 2001; 182:211–4.
2. Guller U, Hervey S, Purves H, *et al.* Laparoscopic versus open appendectomy: outcomes comparison based on a large administrative database. *Ann Surg* 2004;239(1):43.
3. Ali SM, Hassanain M. Laparoscopic versus open appendectomy. *Saudi J Gastroenterol.* 2011;17(4):225-6.
4. Shaikh AR, Sangrasi AK, Shaikh GA. Clinical outcomes of laparoscopic versus open appendectomy. *JLS.* 2009; 13(4): 574–580.
5. Hellberg A, Rudberg C, Kullman E, *et al.* Prospective randomized multicentre study of laparoscopic versus open appendectomy. *Br J Surg.* 1999; 86(1): 48–53.
6. Ortega AE, Hunter JG, Peters JH, *et al.* A prospective, randomized comparison of laparoscopic appendectomy with open appendectomy. Laparoscopic Appendectomy Study Group. *Am J Surg* 1995;169(2):208–212; discussion 212–213.
7. Heikkinen TJ, Haukipuro K, Hulkko A. Cost-effective appendectomy. Open or laparoscopic? A prospective randomized study. *Surg Endosc.* 1998;12(10):1204–1208.
8. McCahill LE, Pellegrini CA, Wiggins T, *et al.* A clinical outcome and cost analysis of laparoscopic versus open appendectomy. *Am J Surg.* 1996; 171(5): 533–537.
9. Katkhouda N, Mason RJ, Towfigh S, *et al.* Laparoscopic versus open appendectomy: a prospective randomized double-blind study. *Ann Surg* 2005;242(3):439–448; discussion 448-450.
10. Shimoda M, Maruyama T, Nishida K, *et al.* Comparison of clinical outcome of

- laparoscopic versus open appendectomy, single-center experience. *Heliyon* 2018;4:e00635.
11. Hellberg A, Rudberg C, Kullman E, *et al.* Prospective randomized multicentre study of laparoscopic versus open appendectomy. *Br J Surg.* 1999; 86:48–53.
  12. Heikkinen TJ, Haukipuro K, Hulkko A. Cost-effective appendectomy. Open or laparoscopic? A prospective randomized study. *Surg Endosc.* 1998; 12:1204–8.
  13. Kehagias I, Karamanakis SN, Panagiotopoulos S, Panagopoulos K, Kalfarentzos F. Laparoscopic versus open appendectomy: which way to go? *World J Gastroenterol.* 2008;14(31):4909-14.
  14. Lin HF, Wu JM, Tseng LM, Chen KH, Huang SH, Lai IR. Laparoscopic versus open an appendectomy for perforated appendicitis. *J Gastrointest Surg.* 2006; 10:906–10.
  15. McCahill LE, Pellegrini CA, Wiggins T, Helton WS. A clinical outcome and cost analysis of laparoscopic versus open appendectomy. *Am J Surg.* 1996; 171: 533–537.
  16. Katkhouda N, Mason RJ, Towfigh S, Gevorgyan A, Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. *Ann Surg.* 2005; 242:439–448.
  17. Garbutt JM, Soper NJ, Shannon WD, Botero A, Littenberg B. Meta-analysis of randomized controlled trials comparing laparoscopic and open appendectomy. *Surg Laparosc Endosc.* 1999;9: 17–26.
  18. Sauerland S, Lefering R, Holthausen U, Neugebauer EA. Laparoscopic vs conventional appendectomy—a meta-analysis of randomised controlled trials. *Langenbecks Arch Surg.* 1998;383: 289–295.
  19. Tate JJ. Laparoscopic appendectomy. *Br J Surg.* 1996;83: 1169–70.
  20. Chung RS, Rowland DY, Li P, Diaz J. A meta-analysis of randomized controlled trials of laparoscopic versus conventional appendectomy. *Am J Surg.* 1999; 177: 250–6.
  21. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. *Lancet.* 2015; 386:1278–87.
  22. Di Saverio S, Birindelli A, Kelly MD, Catena F, Weber DG, Sartelli M, *et al.* WSES Jerusalem guidelines for diagnosis and treatment of acute appendicitis. *World J Emerg Surg.* 2016; 11:34.
  23. Di Saverio S, Mandrioli M, Birindelli A, Biscardi A, Di Donato L, Gomes CA, Piccinini A, Vettoretto N, Agresta F, Tugnoli G, Jovine E. Single-Incision Laparoscopic Appendectomy with a Low-Cost Technique and Surgical-Glove Port: “How To Do It” with Comparison of the Outcomes and Costs in a Consecutive Single-Operator Series of 45 Cases. *J Am Coll Surg.* 2016; 222: e15–30.
  24. Di Saverio S. Emergency laparoscopy: a new emerging discipline for treating abdominal emergencies attempting to minimize costs and invasiveness and maximize outcomes and patients’ comfort. *J Trauma Acute Care Surg.* 2014; 77:338–50.
  25. Shaikh AR, Sangrasi AK, Shaikh GA. Clinical Outcomes of laparoscopic versus open Appendectomy. *JSLs.* 2009; 13: 574–80.
  26. Agresta F, De Simone P, Leone L, Arezzo A, Biondi A, Bottero L, *et al.* Italian Society of Young Surgeons (SPIGC). Laparoscopic appendectomy in Italy: an appraisal of 26,863 cases. *J Laparoendosc Adv Surg Tech A.* 2004; 14:1–8.

27. Di Saverio S, Mandrioli M, Sibilio A, Smerieri N, Lombardi R, Catena F, Ansaloni L, Tugnoli G, Masetti M, Jovine E. A cost-effective technique for laparoscopic appendectomy: outcomes and costs of a case-control prospective single-operator study of 112 unselected consecutive cases of complicated acute appendicitis. *J Am Coll Surg*. 2014;218:e51-65.
28. Tashiro J, Einstein SA, Perez EA, Bronson SN, Lasko DS, Sola JE. Hospital preference of laparoscopic versus open appendectomy: Effects on outcomes in simple and complicated appendicitis. *J Pediatr Surg*. 2016;51(5):804-9.
29. Vallina VL, Velasco JM, McCulloch CS. Laparoscopic versus conventional appendectomy. *Ann Surg*. 1993; 218(5): 685-92.
30. Tarnoff M, Atabek U, Goodman M, Alexander JB, Chrzanowski F, Mortman K *et al*. A comparison of laparoscopic and open appendectomy. *JLS*. 1998; 2(2):153-8.
31. Gotz F, Pier A, Bacher C. Modified laparoscopic appendectomy in surgery: a report on 388 operations. *Surg Endosc*. 1990;4(1):6-9.
32. Yu G, Han A, Wang W. Comparison of laparoscopic appendectomy with open appendectomy in treating children with appendicitis. *Pak J Med Sci*. 2016; 32(2): 299-304.
33. Salamone G, Licari L, Atzeni J, Tutino R, Gulotta G. Histologic considerations about a rare case of recurrent incisional hernia on McBurney incision. *Ann Ital Chir*. 2014;85pii: S2239253X14022828.
34. Yong JL, Law WL, Lo CY, Lam CM. A comparative study of routine laparoscopic versus open appendectomy. *JLS*. 2006; 10:188-92.
35. Pedersen AG, Petersen OB, Wara P, Rønning H, Qvist N, Lauberg S. Randomized clinical trial of laparoscopic versus open appendectomy. *Br J Surg*. 2001; 88:200-5.
36. Marzouk M, Khater M, Elsadek M, Abdelmoghny A. Laparoscopic versus open appendectomy: a prospective comparative study of 227 patients. *Surg Endosc*. 2003; 17:721-4.
37. Katkhouda N, Mason RJ, Towfigh S. Laparoscopic versus open appendectomy: a prospective, randomized, double-blind study. *Adv Surg*. 2006; 40:1-19