

Laparoscopic Appendectomy, A Safe and Feasible Procedure in Emergency Department of a Public Sector Hospital

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ABSTRACT

Objectives: To evaluate laparoscopic appendectomy (LA) in terms of operative outcomes in the Emergency Department of a public sector hospital

Methodology: A prospective observational study was conducted at Benazir Bhutto Hospital in Rawalpindi over five years from March 2019 to March 2024. During this time, data was collected by proforma from patients who had undergone laparoscopic appendectomy for acute appendicitis. The data was obtained using a consecutive non-probability sampling technique.

Results: From March 2019 to March 2024, 128 patients underwent laparoscopic appendectomy, with a maximum follow-up of one month. The study comprised 60 males (46.2%), and 68 women (53.7%). The average age was 28 ± 7.8 years. The mean operational time was 40±20 minutes. 3.3% of surgeries needed a conversion to open appendectomy. The average length of stay was 1.5±3 days. On day one, post-operative discomfort on the visual analog scale averaged approximately 6, although it gradually decreased. The average time it took for patients to resume physical activity after surgery was 6 hours. There were no deaths over the 30-day postoperative period. There were no complications other than port site skin infection in three patients, an intrabdominal abscess in one, and fever in nine.

Conclusion: Our study suggests that laparoscopic appendectomy performed in emergency is a safe, minimally invasive treatment with good outcomes.

Key words: Acute Appendicitis, Laparoscopic Appendectomy, Emergency appendectomy.

Authors' Contribution:

^{1,2}Conception; ¹Literature research; ¹manuscript design and drafting; ^{3,4}Critical analysis and manuscript review; ^{5,6}Data analysis; Manuscript Editing.

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Article info:

Received: May 17, 2024
Accepted: June 15, 2024

Cite this article. Khan HS, Wadood A, Khan A, Naureen I, Arslan S, Malik NA. Laparoscopic Appendectomy, A Safe and Feasible Procedure in Emergency Department of a Public Sector Hospital. *J Islamabad Med Dental Coll.* 2024; 13(3): 415-421
DOI: <https://doi.org/10.35787/jimdc.v13i3.1217>

Funding Source: Nil

Conflict of interest: Nil

Introduction

The commonest etiology of acute abdominal presentations in young individuals is acute appendicitis.¹ Kurt Semm introduced laparoscopic appendectomy in 1983.² Laparoscopic appendectomy (LA) initially could not establish itself as a better technique over open surgery. Open appendectomy (OA) has maintained its status as the

gold standard especially in complicated appendicitis since its introduction by McBurney.³ The management is uniform among surgical practitioners, and unlike cholecystectomy, OA is frequently conducted via a small incision in the lower right quadrant, with subsequent postoperative recuperation typically proceeding uneventfully. Laparoscopic appendectomy offers

many benefits including a shorter length of stay in the hospital, reduced need for analgesic medication after surgery, and an earlier return to physical activity. However, the procedure has longer operative time, particularly for less experienced surgeons. Although there is a lower incidence of post-operative wound infection, there is a higher risk of intra-abdominal abscesses.⁴ When it comes to treating young individuals in particular, LA is more effective but expensive than OA.⁵ The advantages of laparoscopic appendectomy have not yet been proven it, to be better than open appendectomy but it has been shown to be safe and feasible surgery in resource limited settings.⁶ To evaluate emergency laparoscopic appendectomy as a safe minimally invasive surgery having good outcomes and minimal post-operative complications, we prospectively followed patients in our research. In terms of an early return to work, LA, as a minimally invasive procedure, can aid in improved patient management.⁷ Hiramatsu K et al showed that laparoscopic appendectomy can be safely done by residents in emergency who are not trained in open appendectomy.⁸ Adopting LA as an outpatient technique has been supported by recent research.⁸

Methodology

128 carefully chosen patients received LA at Benazir Bhutto Hospital Rawalpindi throughout this five-year study, which ran from March 2019 to March 2024. The committee for ethics granted its approval. In a prospective observational study, patients were followed for one month to prospectively investigate post-operative recovery and problems. A non-probability, consecutive sampling technique was used to get the data. Under the supervision of specialists, third- and fourth-year residents carried out surgeries with the assistance of first- and second-year residents. First-year residents were trained to monitor patients after surgery. A proforma was created and completed by residents based on their evaluation of patients both during the

immediate post-operative phase and during follow-up. Informed consent was obtained from all the participants. Patients who lost to follow up were excluded from the study. Patients were diagnosed on basis of a history of right iliac fossa pain, having tenderness and rebound tenderness in right iliac fossa on examination, and a leucocyte count of 10,000 or more. Patients aged 15 years and above were included in this study. Patients more than 70 years old were excluded from the study. Patients with history of pain for more than five days and who were suspected clinically of perforated appendix were also excluded. The patients were admitted through the emergency department and received a single dose of intravenous antibiotic (ceftriaxone) before the surgical procedure. Laparoscopic appendectomy (LA) was carried out utilizing the three-port method. A 5-10 mm port was positioned below the umbilicus, another 5mm port in the suprapubic region, and a third 5mm port in the left iliac fossa. The pneumoperitoneum was established to create the operating space. The appendix was identified and grasped. The mesoappendix was excised using cautery with the assistance of a Maryland dissector. The base of the appendix was ligated with a vicryl 2/0 suture using intracorporeal knotting or Roeder's knot, followed by resection. Subsequently, the removed appendix was extracted through the 10mm port. The skin was exclusively sutured with vicryl 2/0 subcuticular sutures for the 5mm port sites. At the 10mm port site, the first fascial sheath was sutured with vicryl 1/0, followed by skin closure with vicryl 2/0. Patients were monitored after surgery. Sips and liquids were started offered at zero postoperative day, then on the first day of surgery, semisolids were resumed. During the patients' stay in the hospital, intravenous antibiotic injection ceftriaxone was administered twice a day. After discharge, oral doses were advised for 3 days. Patients who were pain-free, vitally stable, and able to accept an oral diet were discharged from the hospital. The operating time was recorded as the duration between the initiation

of anesthesia and the completion of skin suturing. Conversion was defined as the shift from laparoscopic appendectomy to open appendectomy. Post-operative pain was evaluated using a visual analogue scale graded from 0 to 10, with 10 denoting the most intense level of pain. Early resumption of diet encompassed the progression from a liquid diet to a semi-solid diet following the presence of bowel sounds. The resumption of physical activity was determined by the patient's ability to assume a sitting position, mobilize from the bed, and ambulate. Resumption of activity was measured as being a) Without difficulty b) with some difficulty c) very difficult, and d) unable to do it. The response was measured 6-10 hours post-operatively. Hospital stay was counted in days. After the surgery, the surgical complications were documented such as fever (temperature >100 degrees Fahrenheit), intrabdominal abscesses (confirmed by ultrasound), port site infection (redness and discharge requiring early suture removal), urinary retention (inability to pass urine voluntarily), and prolonged hospital stay (more than 5 days after the surgery). Data was collected using proforma. Data was analyzed using SPSS 22. Mean age \pm standard deviation was calculated. The male and female ratio was calculated. The intra-operative parameters, postoperative outcomes and post-operative complications were calculated as frequency and percentages.

Results

Among the 128 patients, 60 (46.2 %) were men and 68 (53.7 %) women. The mean age was 28 ± 7.8 years. The operative parameters are discussed in table I.

The postoperative pain scores as measured by Visual analogue score were low and mean duration of resumption of oral intake was 6 ± 2 hours. 96% of the patients were able to mobilize with little or no difficulty (table II).

Table I: Intraoperative Parameters of Laparoscopic Appendectomy (n: 128)

Parameters	Values
Operative time (Mean \pm SD)	40 \pm 20 mins
Duration of hospital stay (Mean \pm SD)	1.5 \pm 3 days
Conversion to open procedure	4 (3.3 %)

Table II: Post-Operative Outcomes of patients undergoing Laparoscopic Appendectomy

Outcome Measures	Values, n: 128
Post-operative pain score on VAS (mean)	4 \pm 3
Duration of resumption of diet (mean)	6 \pm 2 hours
Early resumption of activity	
Without difficulty	62 (48%)
With some difficulty	60 (46%)
Very difficult	6 (4.6%)
Unable to do it	0 (0 %)

Table III: Post –Operative complications

Complications	Number of Patients, n: 128
Postoperative fever	11 (8.5%)
Intrabdominal abscess	3 (2.3%)
Port site infection	5 (3.9 %)
Mortality	0 (0%)
Prolonged length of stay	9 (7 %)
Urinary retention	2 (1.5%)

Postoperative complications in patients undergoing lap appendectomy were documented. Among 128 patients 11 patients had a fever and two developed urinary retention which was relieved by indwelling catheter. There was no mortality. Five of the

patients developed port site infections post-operatively as shown in Table III. Three patients developed intrabdominal abscesses. One of these was managed conservatively by intravenous antibiotics and two needed radiologically guided drainage

Discussion

Acute appendicitis is the most common reason for emergency department visits worldwide.⁴ Laparoscopic appendectomy is now the preferred procedure for treating acute appendicitis.⁹ While open appendectomy used to be a common procedure performed by surgical trainees, laparoscopic appendectomy is still struggling to gain widespread use in emergency departments due to the lack of infrastructure and expertise especially in developing countries and under developed countries. This study demonstrates that Laparoscopic appendectomy is an effective technique with minimal post-operative complications when performed in emergency situations. We carried out a descriptive prospective study involving 128 patients and followed them for one-month post-operatively. The mean operating time observed in our study was 40 ± 20 minutes, a figure consistent with those reported in other studies. Biondi A et al found that operative time was significantly shorter in the open appendectomy (31.36 ± 11.13 min) as compared to (54.9 ± 14.2 min) in laparoscopic appendectomy.⁴ This duration notably exceeds the average operating time of 25 minutes for open appendectomies.^{2,9} Usually, laparoscopic appendectomies typically require a longer operating time.^{7,9,10,11} While some studies have indicated that the difference in operating time was not statistically significant,⁷ this observation may be attributed to the additional time necessary for tasks such as tubing adjustments, insufflation, telescope setup, optimizing visibility, and meticulous fascial closure through a small incision. Only four of the laparoscopic appendectomy procedures

required conversion to an open procedure. This can be attributed to the procedures being conducted by skilled laparoscopic trained residents under the supervision of consultants, with careful patient selection that excluded those with suspected perforated appendix or appendicular mass. This was corroborated by other studies that laparoscopic appendectomy in carefully selected patients can be completed successfully without conversion.¹² Ahmad HV conducted a study on laparoscopic appendectomy in a peripheral hospital in India. They found that only two patients out of 108 (1.8%) required conversion to open surgery.⁷ The average hospital stay in our study was 1.5 ± 3 days, a duration consistent with findings in other studies.^{6,7,9,13-15} Antonio Biondi et al found that laparoscopic appendectomy was associated with a shorter hospital stay of 1.4 ± 0.6 days in LA and 2.7 ± 2.5 days in OA ($P = 0.015$).⁴ The mean hospital stay in this study after LA is almost similar to our finding of 1.5 days. Tomoya Takami et al documented that the duration of hospital stay was shorter for the LA group (9.61 ± 5.57 versus 12.19 ± 8.4 ; $p = 0.016$) even in patients with complicated appendicitis [12]. A meta-analysis found that the length of hospital stay in the LA groups were significantly shorter than those in the OA groups (weighted mean difference, WMD = -2.47 , 95% CI: -3.75 to -1.19 , $P < 0.0002$).¹⁵ However, certain studies have reported no significant difference in hospital stay between open and laparoscopic appendectomy.⁴ Literature shows reduced postoperative pain within the initial 12 hours following the laparoscopic appendectomy.^{4,9} A study showed that the laparoscopic group required fewer doses of parenteral and oral analgesics in the operative and postoperative periods compared with the open appendectomy ($P < 0.0001$).⁴ Our study registered a mean VAS score of 4. This score notably contrasts with the typically higher pain levels experienced by patients undergoing open appendectomy during the early postoperative period. This reduction can be attributed to the implementation of smaller

incisions and the elimination of muscle retraction or splitting done open appendectomy. Consequently, there was a diminished necessity for postoperative analgesics, facilitating the early transition of patients to oral non-narcotic analgesia. The resumption of bowel sounds and subsequent initiation of diet occurred relatively early in our study, with an average duration of 6 hours. This is in accordance with international studies.^{7,16} This expedited recovery is attributed to the minimal handling of the gastrointestinal tract during laparoscopic appendectomy (LA) and the delicate use of instruments, facilitating clear visualization of the entire abdominal cavity and specifically the right iliac fossa. This approach resulted in reduced post-operative ileus compared to traditional open procedures. However, it is noteworthy that certain studies have not demonstrated a statistical advantage of LA in terms of postoperative ileus, linking this phenomenon to the duration of the operation.^{4,9,10} Tomoya Takami et al¹² found that there were no significant differences in return to consumption of oral intake between the LA and OA groups (2.03 ± 1.66 versus 2.48 ± 2.17 ; $p = 0.123$). Thus, it can be said that LA is comparable to OA in terms of resumption of oral diet. The mitigation of pain contributed to the early resumption of patient activity. Notably, 94% of patients achieved mobility without difficulty, or with minimal difficulty, while a mere 4% encountered challenges, and none of the patients experienced complete immobility. Antonio Biondi et al documented a faster return to daily activities 11.5 ± 3.1 days in LA and 16.1 ± 3.3 in OA.⁴ These findings align with existing research, underscoring the patient comfort benefits of laparoscopic appendectomy.^{7,17} Nine patients had an extended hospital stay of over 5 days. One of these patients was 60 years old and had co-morbidities, including COPD, leading to post-operative pneumonia and fever. This finding is consistent with existing literature indicating a correlation between age, co-morbidities, and prolonged hospital stays.¹³ Other patients were

those who developed some complications like intrabdominal abscess and fever. The incidence of post-operative complications was deemed acceptable, as only 3.9% of patients experienced a port site infection. This rate aligns with findings from randomized controlled trials and may be attributed to the approach to appendix retrieval in laparoscopic appendectomy, minimizing incision contact, as opposed to open appendectomies.^{9,10} Rasoili S et al showed that wound related complications were significantly lower in patients who underwent laparoscopic appendectomy than those who underwent open appendectomy (23.53% versus 40.5%; $p = 0.013$).¹¹ Man-Cheng Yu et al performed a meta-analysis of two randomized controlled trials (RCTs) and 14 retrospective cohort studies (RCSs) and showed that laparoscopic appendectomy for complicated appendicitis could reduce the rate of surgical site infections (SSIs) (OR = 0.28; 95% CI: 0.25 to 0.31, $P < 0.00001$).¹⁵ In our research, 8.5% ($n=11$) of patients presented with a mild post-operative fever, while only one patient experienced a high-grade fever. The low-grade fevers are likely attributed to the body's response to infection and the surgical procedure.¹ The patient exhibiting a high-grade fever had an elevated total leukocyte count (TLC) pre-surgery and was administered antibiotics, resulting in a gradual resolution of the fever during the postoperative period. In this study, only three patients experienced an intrabdominal abscess as a complication, potentially due to meticulous patient selection. Early literature indicated that abscesses are more prevalent following laparoscopic appendectomy for gangrenous or perforated appendicitis, as abdominal irrigation is typically omitted. Prior studies have illustrated an elevated risk of intra-abdominal abscesses.^{2,3} However, recent literature suggests that laparoscopic appendectomy offers improved access to visualize all abdominal spaces and conduct comprehensive irrigation. A study by Man-Cheng Yu et al found that LA did not increase the rate of postoperative intra-abdominal abscess

(IAA) (OR = 0.79; 95% CI: 0.45 to 1.34, P = 0.40).¹⁵ There were no mortalities within the immediate 30-day post-operative period, suggesting that laparoscopic appendectomy is a safe procedure. The overall mortality rate for appendectomy is exceedingly low, estimated at 0.05% for laparoscopic appendectomy and 0.3% for open appendectomy based on an extensive review of a large administrative database.¹⁴ Notably, urinary retention occurred in only two patients, indicating that it is not a significant complication following laparoscopic appendectomy as shown by other studies.⁴ The clinical outcome parameters reveal that laparoscopic appendectomy provides the advantages of a minimally invasive approach, resulting in reduced post-operative pain and an earlier resumption of diet and physical activity.⁴ Other studies have shown LA benefits.¹⁸⁻²² Hence laparoscopic appendectomy is a safe procedure when done in emergency by residents.²³ Ahmad HV concluded that laparoscopic appendectomy is safe and feasible in expert hands.⁷ Kosuke Hiramatsu demonstrated that laparoscopic appendectomy is safe even when performed by surgical residents without training for open appendectomy.⁸ Our study is subject to limitations, given its descriptive nature. The reported favorable outcomes, such as shorter post-operative time, reduced pain, and early resumption of diet and activity, necessitate validation through a blinded multicenter randomized controlled trial. It is essential to note that our patient cohort for laparoscopic appendectomy (LA) was carefully selected, potentially introducing selection bias. Our investigation did not encompass an evaluation of LA advantages in obese patients, the establishment of alternate diagnoses, cost-effectiveness, or the mitigation of post-operative adhesions. Furthermore, our study did not specifically scrutinize reported benefits in elderly patients or children under 15 years of age. While our findings indicate the safety of laparoscopic appendectomy when performed in emergencies by residents, a

comparative analysis with the outcomes of open appendectomy by residents is warranted.

Conclusion

Laparoscopic appendectomy is considered a safe and minimally invasive technique when performed in the emergency department, exhibiting positive clinical outcomes. A randomized controlled trial between open and laparoscopic appendectomy done by residents in emergency should be conducted to establish the feasibility of laparoscopic appendectomy.

References

1. P. Ronan O'Connell, Andrew W. McCaskie, Robert D. Sayer ,editors. Bailey & Love's Short practice of Surgery. 28th Ed. London: Hodder Arnold; 2022.
2. Semm K. Endoscopic appendectomy. *Endoscopy*. 1983; 15:59-64.
3. McBurney C. The incision made in the abdominal wall in case of appendicitis with a description of a new method of operating. *Annals of Surgery*. 1894; 20:38-43. <https://doi.org/10.1097%2F00000658-189407000-00004>
4. Biondi A, Di Stefano C, Ferrara F, Bellia A, Vacante M, Piazza L. Laparoscopic versus open appendectomy: A retrospective cohort study assessing outcomes and cost-effectiveness. *World Journal of Emergency Surgery*. 2016 Aug 30;11(1). <https://doi.org/10.1186/s13017-016-0102-5>
5. Meena S, Badkur M, Rodha M, Lodha M, Puranik A, Premi K. Feasibility of safe laparoscopic surgery performed by junior residents without exposure of open appendectomy: A retrospective study. *Journal of Family Medicine and Primary Care*. 2022;11(2):581. https://doi.org/10.4103/jfmpc.jfmpc_1196_21
6. Ching- Chung Tsai, Shin-Yi Lee, Fu-Chen Huang. Laparoscopic versus Open Appendectomy in the Management of All Stages of Acute Appendicitis in Children: A Retrospective Study. *Pediatrics and neonatology Elsevier*. 2012 Oct;53(5):289–294.
7. Ahmed HV, Mushtaque M. Laparoscopic appendectomy for acute appendicitis: An observational study from a peripheral hospital with limited facilities in Kashmir, India. *International Surgery Journal*. 2020 Feb 26;7(3):717. <https://doi.org/10.18203/2349-2902.isj20200810>
8. Hiramatsu K, Toda S, Tate T, Fukui Y, Tomizawa K, Hanaoka Y, et al. Can laparoscopic appendectomy be safely performed by surgical residents without prior

- experience of open appendectomy? *Asian Journal of Surgery*. 2018 May;41(3):270–3. <https://doi.org/10.1016/j.asjsur.2016.12.003>
9. Cash CL, Frazee RC, Smith RW, Davis ML, Hendricks JC, Childs EW, et al. Outpatient laparoscopic appendectomy for acute appendicitis. *The American Surgeon*. 2012; 78(2):213–215]
 10. Nazir A, Farooqi SA, Chaudhary NA, Bhatti HW, Waqar M, Sadiq A. Comparison of open appendectomy and laparoscopic appendectomy in perforated appendicitis. *Cureus*. 2019 Jul 9; <https://doi.org/10.7759/cureus.5105>
 11. Rasuli SF, Naz J, Azizi N, Hussain N, Qureshi PN, Swarnakari KM, et al. Laparoscopic versus open appendectomy for patients with perforated appendicitis. *Cureus*. 2022 Jun 23; <https://doi.org/10.7759/cureus.26265>
 12. Takami T, Yamaguchi T, Yoshitake H, Hatano K, Kataoka N, Tomita M, et al. A clinical comparison of laparoscopic versus open appendectomy for the treatment of complicated appendicitis: Historical cohort study. *European Journal of Trauma and Emergency Surgery*. 2019 Feb 2;46(4):847–51. <https://doi.org/10.1007/s00068-019-01086-5>
 13. Gupta N, Machado-Aranda D, Bennett K, Mittal VK. Identification of preoperative risk factors associated with the conversion of laparoscopic to open appendectomies. *Int Surg*. 2013 Oct-Dec;98(4):334–9
 14. Wang D, Dong T, Shao Y, Gu T, Xu Y, Jiang Y. Laparoscopy versus open appendectomy for elderly patients, a meta-analysis and systematic review. *BMC Surgery*. 2019 May 28;19(1). <https://doi.org/10.1186/s12893-019-0515-7>
 - Yu M-C, Feng Y, Wang W, Fan W, Cheng H, Xu J. Is laparoscopic appendectomy feasible for complicated appendicitis? A systematic review and meta-analysis. *International Journal of Surgery*. 2017 Apr; 40:187–197. <https://doi.org/10.1016/j.ijssu.2017.03.022>
 15. Lomanto D, Chen WT-L, Fuentes MB. *Mastering endo-laparoscopic and thoracoscopic surgery: Elsa Manual*. Singapore: Springer Nature; 2023. pp 99–102. https://doi.org/10.1007/978-981-19-3755-2_17
 16. Yasmeen Vellani, Shaheena Bhatti, Ghina Shamshi, Yasmeen Parpio, Tazeen saeed Ali. Evaluation of Laparoscopic Appendectomy vs. Open Appendectomy: A Retrospective Study at Aga Khan University Hospital, Karachi, Pakistan. *JPMA*. 2009; 59:605.
 17. Ali R, Khan MR, Pishori T, Tayeb M. Laparoscopic appendectomy for acute appendicitis: Is this a feasible option for developing countries? *Saudi J Gastroenterol* 2010; 16:2. <https://doi.org/10.4103%2F1319-3767.58764>
 18. Awad ali abdelmonem, seweny hassan, mohammed mohammed, nawar ahmed. Laparoscopic appendectomy versus open appendectomy in young female patients. *Benha Medical Journal*. 2021 Feb 22;0(0):0–0. <https://doi.org/10.21608/bmfj.2020.18734.1144>
 19. De Wilde RL. Goodbye to late bowel obstruction after appendectomy. *Lancet*. 1991; 338:101. [https://doi.org/10.1016/0140-6736\(91\)91871-q](https://doi.org/10.1016/0140-6736(91)91871-q)
 20. Khan TH, Hussain SA, Khan AG, Jamil T, Hussain F, Fatima S. Clinical outcomes of laparoscopic appendectomy in complicated appendicitis among young children. *Pakistan Journal of Medical and Health Sciences*. 2022 Nov 30;16(12):891–3. <https://doi.org/10.53350/pjmhs20221611891>
 21. Ferrarese AG, Martino V, Enrico S, Falcone A, Catalano S, Pozzi G, et al. Laparoscopic appendectomy in the elderly: our experience. *BMC Surg*. 2013 Oct 8;13 Suppl 2: S22. <https://doi.org/10.1186%2F1471-2482-13-S2-S22>