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Laparoscopic Appendectomy versus Open Appendectomy in Acute Appendicitis

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ABSTRACT

Background: Appendectomy is the most common emergency surgical procedure performed. Appendectomy is performed by either open or laparoscopic methods. However, there is lack of consensus regarding the most appropriate method. This study aimed to compare the outcomes of laparoscopic and open appendectomy in the treatment of acute appendicitis.

Methods: Fifty-two patients undergoing appendectomy were analyzed in this prospective comparative study, with 26 patients each in laparoscopic and open group. The outcomes were measured in terms of operative time, postoperative pain at 4, 6 and 12 hours, length of hospital stay, postoperative complications according to modified Clavien Dindo classification and cost analysis.

Results: Laparoscopic group had longer time after completion of surgery till exit from operation theatre (30 min in laparoscopic and 20 min in open, $p<0.01$) and significantly higher cost (Nrs. 26295 for laparoscopic and Nrs. 19575 for open, $p<0.01$) than open appendectomy. Operative time, time from entering operation theatre till being kept in operation table, time from being kept in operation table till initiation of anesthesia, postoperative pain at 4,6 and 12 hours and postoperative complications were insignificant in both groups.

Conclusions: The results suggest that laparoscopic appendectomy group had longer recovery time after operation and was costlier than open appendectomy. Thus, the decision of the operative procedure can be based on the patient's preference.

Keywords: Appendectomy; laparoscopic appendectomy; open appendectomy

INTRODUCTION

Acute appendicitis is the most common abdominal surgical emergency.[1] Accordingly, appendectomy is one of the most frequently performed surgical procedures worldwide.[2] The standard treatment for appendicitis is appendectomy.[1]

Laparoscopic appendectomy (LA) has become the standard of practice in uncomplicated appendectomies in most minimally invasive institutions.[3] Open appendectomy (OA) is widely considered gold standard in complicated appendicitis due to decreased intra-abdominal infectious complications in the postoperative period.[3] The advantages of LA include decreased postoperative pain, shorter hospital stay, earlier return to full activity, better cosmesis, and lower wound infection rates versus OA.[4] Both surgical methods are safe and well established in clinical practice but there has been a controversy about which surgical procedure is the most appropriate.[5, 6]

This study aimed to compare the outcome of LA with OA, helping surgeons make decision regarding the choice of operative procedure for acute appendicitis.

METHODS

This was a prospective comparative study of 1 year duration conducted in Department of Surgery, Patan Academy of Health Sciences (PAHS).

Patients of age more than 14 years admitted with diagnosis of acute appendicitis and planned for appendectomy were included in the study. Patients with palpable mass in right lower quadrant, contraindication to laparoscopic surgery, other diagnosis during surgery, admitted in private ward, and in whom LA converted to OA were excluded. Patients were divided into two groups. First group included the patients undergoing laparoscopic appendectomy and second group included the patients undergoing open appendectomy.

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Patients were given details about both the operative procedures including the cost and were asked to choose the operative procedure they would like to undergo. Groups were divided based on the operative procedure patients prefer.

After fulfilling the inclusion criteria, informed consent was taken. For patients younger than 16 years of age, the patient's relatives made the choice regarding the operative procedure.

OA was performed on spinal anesthesia (SA). Lanz incision was given. Following appendectomy, the stump was transfixed with poly(glycolide-co-L-lactide), braided, coated, absorbable suture.

LA was performed on general anesthesia (GA). Three ports were used, one 10 mm umbilical port, second 5 mm suprapubic port and a third 5mm left iliac fossa port. Mesoappendix dissection was performed using either Bipolar or Enseal (Johnson & Johnson®) or Ultrasonic dissector (Olympus Thunderbeat®). Base of appendix was ligated with readymade endoloop or endoknot constructed with a Roeder knot. Appendix was removed from umbilical port.

The patients were kept in recovery room inside the OT after the surgery and then they were transferred to ward.

Regarding analgesics, for patients 50 kg or more, Ketorolac 30 mg IV 8 hourly, which was changed to oral Ketorolac 10 mg once patient was allowed orally, and Paracetamol 1 gm PO 6 hourly (once the patient is allowed orally) was given for the first 24 hours starting after 3 hours of exit from OT or whenever patient complained of pain before 3 hours. For patients less than 50 kg, Paracetamol 15 mg/kg/dose PO and Ketorolac 0.5 mg/kg/dose IV then PO, once patient was allowed orally, was given. Further analgesics were given based on patient's perception of pain, for which parenteral Tramadol 50 mg IV with Ondansetron 4 mg IV was given. If pain control was still unsatisfactory, Morphine 0.1 mg/kg IM was given.

Patient was discharged once patient was able to ambulate, tolerate soft diet and without features of Systemic Inflammatory Response Syndrome (SIRS).

Patients were followed up on 7-8 days after surgery at OPD. Staplers were removed on first planned follow up (i.e after 7-8 days).

Postoperative complication was managed accordingly.

Operating time was time of first incision up to placement of last stapler on the closing wound. Mann Whitney U test was used to compare the operative time between LA and OA groups. OA was performed by lecturers and above or by residents under supervision of on-call surgeon. LA was performed by lecturers and above with the experience on laparoscopic surgery of 1 year or more. Operation theatre (OT) time was time of entry in OT to the exit from OT in minutes.

Postoperative pain was assessed by Visual Analogue Scale (VAS) score[7] at 4, 6 and 12 hours. VAS using numbers from 0 to 10 was used (Appendix 5), where 0 = No pain, 1-3 = Mild pain, 4-6 = Moderate pain, 7-10 = Severe pain. It was analyzed using Mann Whitney U test.

Length of hospital stay was duration between date of surgery and date of discharge. It was analyzed using Mann Whitney U test in both the groups.

Postoperative complications within the first postoperative week was recorded according to the checklist based on modified Clavien Dindo classification.[8] Fischer's exact test was used to compare the complications.

Cost analysis of total costs for LA and OA from time of admission till discharge was recorded based on the bill at the time of discharge. It was done using Mann Whitney U test.

Taking the dropout rate as 10% in each arm, the minimum sample size in each arm comes out to be 26 and the minimum total sample size is 52.

RESULTS

A total of 52 patients were included in this study. Among them, 26 underwent open appendectomy and remaining 26 underwent laparoscopic appendectomy.

The test revealed median operative time of 62.5 minutes in LA group and 42.5 minutes in OA group, which was statistically insignificant (p = 0.408).

Table 1. Median VAS score at 4, 6 and 12 hours.

Postoperative pain (median score)	LA group	OA group	p-value
At 4 hours	5	5	0.695
At 6 hours	3	3	0.771
At 12 hours	2	2	0.14

Length of hospital stay was 3 days for LA group and 2 days for OA group (p = 0.155). This result was statistically insignificant.

Postoperative complications were either grade 1 or grade 2. There was no grade 3, 4 or 5 complications. There were twenty-four grade 1 complications and two grade 2 complications in LA group and twenty-three grade 1 and three grade 3 complications in OA group, with p-value of 1 which was statistically insignificant.

The cost of LA was Nrs. 26295, which was significantly higher than that of OA, Nrs. 19575 ($p < 0.01$).

DISCUSSION

An accurate preoperative diagnosis of acute appendicitis is challenging, since the diagnosis must be entertained in patients of all ages presenting with an acute abdomen.[2] Although more than 30 years have elapsed since the introduction of laparoscopic appendectomy (performed in 1983 by Semm)[3], open appendectomy is still commonly performed. Some authors consider emergency laparoscopy as a promising tool for the treatment of abdominal emergencies that is able to decrease invasiveness and maximize outcomes and patients' comfort.[9, 10] Several studies have shown that laparoscopic appendectomy is safe and results in a faster return to normal activities with fewer wound complications.[11-13] These findings have been challenged by other authors who observed no significant difference in the outcome between the two procedures, and moreover noted higher costs with laparoscopic appendectomy.[14-16]

Preliminary studies have shown significantly longer operative times for laparoscopic appendectomy.[17, 18] Median operative time in the current study for LA was 62.5 minutes and 42.5 minutes (P = 0.408) for OA. This shows that LA took longer operative time as compared to OA, however, the difference was not clinically significant. A study done by Vincenzo M et al had similar finding of insignificant statistical difference in the mean operative time between laparoscopic (52.2 min; range 20-155) and open appendectomy (49.3 min; range 20-110).[19] Another study done by Islam SR et al also showed statistically insignificant difference of mean operation time for LA (33±5.8 minutes) and OA (37 ±7.5 minutes), which was similar to our finding.[20]

Postoperative pain according to VAS score at 4, 6 and 12 hours were statistically insignificant in both LA and OA groups. A study done by Katkhouda N et al showed similar finding of postoperative pain being similar in both the groups.[15] Another study by Mutter D et al also found that postoperative pain as measured by visual analog scale on postoperative days 1 and 2 were not significantly different between the patients who underwent laparoscopic and open surgery with values of 4.7 versus 4.4 and 2.1 versus 2.2, respectively.[18] OA was performed in SA and LA in GA. The exact amount and frequency of analgesics required was not compared in this study, which would have given a better idea regarding the postoperative pain.

Similarly, the length of the hospital stay was not statistically significant in both the groups. Similar finding was shown by Cothren CC et al who found that open and laparoscopic groups had equivalent hospital days (1.47 versus 1.49).[21]

For postoperative complications within one week, grade 1 complications included the need for use of oral antiemetics, antipyretics, analgesics after discharge or wound infections opened at bedside or at OPD without the need for anesthesia and grade 2 complications included need for use of drugs other than those mentioned for Grade 1 complications (eg. antibiotics) or need for blood transfusions. Number of grade 1 postoperative complications according to modified Clavien Dindo classification was 24 in LA group and 23 in OA group, whereas number of grade 2 complications was 2 in LA group and 3 in OA group. This finding was not statistically significant (p= 1). Similar finding was found in a study done by Katkhouda N et al, which showed that overall complication rate was similar in both groups (18.5% in laparoscopic group versus 17% in open group).[15] Among two patients with grade 2 complications in LA group, one patient had readmission on postoperative day 7 for pain. In OA group, one patient had multiple co-morbidities and was discharged on oral antibiotics. Other patients received antibiotics in postoperative period.

This study also aimed to look at the cost analysis of LA and OA. Cost analysis was statistically significant among the two groups, with LA costing more than OA. The total cost for LA was Rs. 6720 more than that for OA. This finding is consistent with the study done by Apelgren KN et al, which showed the hospital cost being $1400 more for LA.[17] A study done by Cothren CC et al also showed similar findings of significantly higher operative (3,022.16 dollars +/- 57.51 dollars versus 4,065.24 dollars +/- 122.64 dollars) and total hospital charge (12,310 dollars +/- 772 dollars versus 16,773 dollars +/- 1,319 dollars) for LA.[21] Another study done by Biondi A et al showed that the cost of LA was higher than OA by 150 euros.[22] This finding was expected as the OT charge for LA is Rs. 7000 more than that for OA. Besides the expected findings of increased time in recovery room after surgery and increased cost in LA group, other findings were not significantly different. The advantages of LA have been described as decreased postoperative pain, shorter hospital stay, earlier return to full activity, better cosmesis and lower wound infection rates.[4] But

all these parameters were not assessed in this study, which is the limitation of this study.

CONCLUSIONS

Based on these results, operative time, postoperative pain, length of hospital stay and postoperative complications had no statistical significant difference between LA and OA.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. N. DS. Appendicitis. BMJ Clinical Evidence 2011; 2011.
2. Bhangu A, Soreide K, Di Saverio S, Assarsson JH and Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. Lancet (London, England) 2015; 386: 1278-87.[Article]
3. Switzer NJ, Gill RS and Karmali S. The Evolution of the Appendectomy: From Open to Laparoscopic to Single Incision. Scientifica 2012; 2012: 895469.[Article]
4. Sakpal SV, Bindra SS and Chamberlain RS. Laparoscopic appendectomy conversion rates two decades later: an analysis of surgeon and patient-specific factors resulting in open conversion. The Journal of surgical research 2012; 176: 42-9.[Article]
5. Jaschinski T, Mosch C, Eikermann M and Neugebauer EA. Laparoscopic versus open appendectomy in patients with suspected appendicitis: a systematic review of meta-analyses of randomised controlled trials. BMC gastroenterology 2015; 15: 48.[Article]
6. Casarotto A, Zarantonello FR and Rebonato M. Appendectomy in women. Is the laparoscopic approach always better than the "open" approach in uncomplicated appendicitis? Surgical laparoscopy, endoscopy & percutaneous techniques 2014; 24: 406-9.[Article]
7. Haefeli M and Elfering A. Pain assessment. European Spine Journal 2006; 15: S17-S24.[Article]
8. Dindo D, Demartines N and Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Annals of surgery 2004; 240: 205-13.[Article]
9. Di Saverio S, Mandrioli M, Sibilio A, et al. 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. Journal of the American College of Surgeons 2014; 218: e51-65.[Article]
10. 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. The journal of trauma and acute care surgery 2014; 77: 338-50.[Article]
11. Garbutt JM, Soper NJ, Shannon WD, Botero A and Littenberg B. Meta-analysis of randomized controlled trials comparing laparoscopic and open appendectomy. Surgical laparoscopy & endoscopy 1999; 9: 17-26.[Article]
12. Fogli L, Brulatti M, Boschi S, et al. Laparoscopic appendectomy for acute and recurrent appendicitis: retrospective analysis of a single-group 5-year experience. Journal of laparoendoscopic & advanced surgical techniques Part A 2002; 12: 107-10.[Article]
13. Towfigh S, Chen F, Mason R, Katkhouda N, Chan L and Berne T. Laparoscopic appendectomy significantly reduces length of stay for perforated appendicitis. Surg Endosc 2006; 20: 495-9.[Article]
14. Kurtz RJ and Heimann TM. Comparison of open and laparoscopic treatment of acute appendicitis. American journal of surgery 2001; 182: 211-4.[Article]
15. Katkhouda N, Mason RJ, Towfigh S, Gevorgyan A and Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. Annals of surgery 2005; 242: 439-48; discussion 48-50.[Article]
16. Ignacio RC, Burke R, Spencer D, Bissell C, Dorsainvil C and Lucha PA. Laparoscopic versus open appendectomy: what is the real difference? Results of a prospective randomized double-blinded trial. Surg Endosc 2004; 18: 334-7.[Article]
17. Apelgren KN, Molnar RG and Kisala JM. Laparoscopic is not better than open appendectomy. The American surgeon 1995; 61: 240-3.
18. Mutter D, Vix M, Bui A, et al. Laparoscopy not recommended for routine appendectomy in men: results of a prospective randomized study. Surgery 1996; 120: 71-4.[Article]
19. Minutolo V, Licciardello A, Di Stefano B, Arena M, Arena G and Antonacci V. Outcomes and cost analysis of laparoscopic versus open appendectomy for treatment of acute appendicitis: 4-years experience in a district

hospital. BMC surgery 2014; 14: 14.[Article]

20. Islam S, Pasha K, Rahman S, Nasir E, Hanif E and Barman A. Laparoscopic vs Open Appendectomy : A Comparative Study. Bangladesh Journal of Endosurgery 2014; 2: 5.[Article]

21. Cothren CC, Moore EE, Johnson JL, Moore JB, Ciesla DJ and Burch JM. Can we afford to do laparoscopic appendectomy in an academic hospital? American journal of surgery 2005; 190: 950-4.[Article]

22. Biondi A, Di Stefano C, Ferrara F, Bellia A, Vacante M and Piazza L. Laparoscopic versus open appendectomy: a retrospective cohort study assessing outcomes and cost-effectiveness. World journal of emergency surgery : WJES 2016; 11: 44.[Article]