Laparoscopic versus open appendectomy: A comparative study

Dr. Suresh Naik, Dr. Nagendra Yadav and Dr. Firoz

Abstract

Objective: To compare the results of open with laparoscopic appendectomy in terms of postoperative pain, rate of wound infection and hospital stay.

Methods: This quasi-experimental study was conducted in Department of Surgery, Dr D.Y. Patil Medical College, over a period of six months. Patients undergoing surgery for acute appendicitis were randomly assigned into one of the two groups (A or B) after obtaining written and informed consent. In Group-A patients underwent open appendectomy and in Group B laparoscopic appendectomy was performed. Post operatively pain chart and wound infection was recorded and, at the time of discharge, number of days in hospital was calculated.

Result: Sixty patients (38 male, 22 female), with clinical diagnosis of acute appendicitis based on Alvarado score of six and above, were included in the study. They were randomized into 2 groups of A and B with 30 patients in each group. Group-A comprised open appendectomy procedure and Group-B comprised laparoscopic appendectomy. Mean comparison of postoperative pain by visual analogue scale, was significantly low in Group B, compared with Group A, on day 0, 1 and 2. Number of days in Hospital was 4.1±0.8 days in Group A and 1.5±0.06 days in Group B. None of the patients in Group B, while 8 (26.67%) patients in Group A, developed postoperative wound infection at 1 week follow up. Conclusion: Laparoscopic appendectomy is safe and effective. Wound infection and postoperative pain is significantly lower after this mode of surgery.

Keywords: Laparoscopic versus, open appendectomy, acute appendicitis

Introduction

Appendectomy is one of the commonly performed procedures in General surgery. McBurney described the operative technique for right iliac fossa pain using Gridiron incision in 1894. This remained the technique for appendicectomy and did not change much until almost a century later, when in 1983, Semm described the first Laparoscopic appendectomy. 1-5 Laparoscopic appendectomy for appendicitis is considered safe and effective. 6, 7 It has gained popularity in recent years and has become one of the most widely performed procedures using the laparoscope globally.

In our Hospital, appendicectomy is being performed by both techniques depending on the availability of trained staff for laparoscopy and patients' preferences.

We conducted this prospective study to compare the results of open appendectomy with laparoscopic appendectomy in terms of postoperative pain, rate of wound infection and hospital stay, reflecting on early return to work, to justify the increase in apparent cost of procedure. Open appendicectomy (OA) has withstood the test of time for more than a century. The procedure is standardized among surgeons and unlike cholecystectomy, OA is typically completed using a small right lower quadrant incision and postoperative recovery is usually uneventful. The advantages of LA over OA are thought to be less postoperative pain, shorter hospital stay and early return to usual activity.4,5 While the incidence of postoperative wound infection is thought to be lower after the laparoscopic technique, the incidence of postoperative intra-abdominal sepsis may be higher in patients operated on for gangrenous or perforated appendicitis. 4, 5 There are however notions showing only minimal benefit from laparoscopic appendicectomy, with higher cost of this method.

Patients and Methods

Between October 2016 and April 2017 (six months) all patients admitted in the surgical unit of our hospital with right lower quadrant pain were evaluated with the Alvarado score for
appendicitis. Those who scored six or above were diagnosed as acute appendicitis, consent for enrollment in the study and were alternatively assigned to open group and Laparoscopic group. Group comprised of patients that. All patients were informed about the nature of the study and the possibility of conversion to open in case of laparoscopic group. Patients who did not want to undergo the procedure assigned to them were excluded from the enrolment process. Also, the patients whose diagnosis was unclear, had a palpable lump in abdomen and/or Alvarado score at admission was less than 6 were not included. The new patients of both sexes belonging to age group 5-50 years presenting with acute appendicitis. Emergency as well as elective cases were included. Patients with delayed presentation leading to appendicular mass. Patient not willing to participate in the study. Same surgical team performed the procedures and maximum precaution was taken to use similar techniques in all patients within each group. Use of analgesia, general and local anaesthetic agents was also kept similar for all patients.

Antibiotics were given according to the department protocol (Ceftriaxone 1gm and Metronidazole 500mg intravenous in single preoperative and two postoperative doses). Patients found to have gangrenous or perforated appendicitis during surgery were treated with continuation of antibiotics for 5days. Postoperative pain control for both groups was achieved by, NSAIDS (Diclofenac sodium suppository 50mg) at the end of procedure followed by oral analgesic (Mefinemic acid). Intravenous or intramuscular analgesics were used if needed. Hours before oral intake of liquids and solids were initiated were also noted. Total number of days in Hospital was calculated and patients received verbal instructions to return to normal activity after discharge. First follow-up was done on seventh postoperative day for suture removal and wound assessment.

### Statistical Analysis
A statistical package for social sciences (SPSS-10) was used to analyze data. Frequency and percentage were computed for categorical variables like sex, operative finding of appendix, postoperative pain and wound infection for Group A and B. Mean and standard deviation were estimated for quantitative variables like age, duration of surgery, postoperative oral intake of liquid and solid diet, pain score on visual analogue scale (VAS) and number of days in Hospital. Independent sample t-test was applied to compare mean difference between group A and B for age, time of surgery, postoperative intake, pain score (VAS) and hospital stay. Chi square test was used to compare proportion difference between group A and for wound infection. P-value of less than 0.05 was considered significant for the difference.

### Results
Sixty patients with clinical diagnosis of acute appendicitis were randomized into groups A and B, with 30 patients in each group. Group-A patients underwent open appendectomy while patients in Group-B had laparoscopic appendectomy. Patients in the two groups were comparable with regard to their age, sex and clinical features of acute appendicitis (Tables-1 & 2).

| Table 1: Variables in groups A & B with p-values. |
|--------------------------------------------------|
|                                                   |
| **Open Appendectomy**                            |
| **Group A (n=30)**                               |
| **Laparoscopic Appendectomy**                    |
| **Group B (n=30)**                               |
| **P-Value**                                      |
| Age Distribution (Years) Mean ± SD              |
| 25.8±3.5                                        |
| 26.5±4.2                                        |
| 0.485*                                          |
| Sex Distribution                                |
| Male                                             |
| 20                                               |
| 18                                               |
| 0.75                                             |
| Female                                           |
| 10                                               |
| 12                                               |
| 0.67                                             |
| Duration of Surgery (minutes) Mean ± SD          |
| 39.6±5.6                                        |
| 51.8±7.8                                        |
| 0.001                                            |
| Initiation of post op liquid intake (hours) Mean ± SD |
| 10.4±2.3                                        |
| 6.6±1.3                                         |
| 0.001*                                          |
| Initiation of post op solid intake (hours) Mean ± SD |
| 15.4±1.8                                        |
| 8.8±1.9                                         |
| 0.02*                                           |
| Intravenous analgesics (no. of doses) Mean ± SD  |
| 2.8±1.2                                         |
| 1.5±0.4                                         |
| 0.0001                                          |
| Oral analgesics (no. of doses) Mean ± SD         |
| 5.9±1.3                                         |
| 2.7±0.7                                         |
| 0.0001                                          |
| Antibiotics                                     |
| 6 post operative doses                          |
| 2 post operative doses                          |
| Hospital Stay (days) Mean ± SD                  |
| 4.1±0.8                                         |
| 1.5±0.06                                        |
| 0.001                                           |
Migratory right iliac fossa pain and tenderness were common clinical features, followed by anorexia; nausea and elevated temperature.

The mean operative time in Group A was significantly shorter (P=0.0001) than Group B patients (Table-1). The operative findings of appendix in Group A and Group B are shown in Table 2. Oral liquids were started after 10.4±2.3 hours of surgery in open group which was significantly longer (P=0.001) than the laparoscopic group (6.6±1.3 hours). Similarly, the laparoscopic group initiated solid diet much earlier than the open group.

Use of postoperative analgesics, both injectable as well as oral, and antibiotics was significantly less in the laparoscopic group (Table 1). Mean comparison of postoperative pain by visual analogue scale, was significantly low in Group B, compared with Group A, on day 0, 1 and 2 (Table-3).

| Table-2: Preoperative clinical feature and operative findings in groups A & B patients. |
|-----------------------------------------|----------------------------------|------------------|
| Preoperative findings                  | Open Appendectomy (Group A) n=30 | Laparoscopic Appendectomy (Group B) n=30 | P-Values |
| Symptoms                                |                                  |                  |
| Migratory RIF pain                     | 26                               | 24               | 0.78     |
| Anorexia                                | 22                               | 18               | 0.52     |
| Nausea vomiting                         | 20                               | 20               | 1.00     |
| Signs                                   |                                  |                  |
| Tenderness ( RIF )                      | 30                               | 30               | 1.00     |
| Rebound Tenderness                      | 15                               | 20               | 0.39     |
| Elevated Temperature                    | 17                               | 23               | 0.34     |
| Lab                                     |                                  |                  |
| Leukocytosis                            | 30                               | 30               | 1.00     |
| Shift to Left                           | 5                                | 5                | 1.00     |
| Operative findings                      |                                  |                  |
| Non-inflamed                            | 0                                | 0                | -        |
| Inflamed                                | 24                               | 28               | 0.57     |
| Phlegmonous                             | 0                                | 0                | -        |
| Gangrenous                              | 3                                | 1                | 0.32     |
| Perforated                              | 3                                | 1                | 0.32     |

| Table-3: Postoperative pain between open and laparoscopic appendectomy. |
|-----------------------------------------------------------------------|
| Days | Time     | Open Appendectomy (Group A) n=30 | Laparoscopic Appendectomy (Group B) n=30 | P-Values |
|------|---------|---------------------------------|--------------------------------|----------|
| Pain Score(VAS) Mean ± SD (Range)                                   |                                             |                                    |
| Day 0 0900 hrs 1300 hrs 1800 hrs | 7.5±2.4 (6-9) | 5.6±2.1 (5-8) | 0.0018 |
| Day 1 0900 hrs 1300 hrs 1800 hrs | 6.4±1.3 5.8±0.8 4.8±0.6 | 4.5±1.8 3.2±0.6 3.1±0.4 | 0.0001 0.0001 0.0001 |
| Day 2 0900 hrs 1300 hrs 1800 hrs | 4.6±0.8 4.0±0.9 2.3±0.5 | 1.5±0.6 0.8±0.2 0.24±0.03 | 0.0001 0.0001 0.0001 |
The hospital stay was 4.1±0.8 days in Group A and 1.5±0.06 days in Group B (P=0.001). None of the patients in Group B while, 8 (26.67%) patients in Group A developed postoperative wound infection at 1 week follow up.

Discussion
Appendectomy is the treatment of choice for acute appendicitis and is by far the most commonly performed emergency abdominal operation. Although, open appendectomy is considered a safe and effective operation for acute appendicitis with low morbidity, however, variability in the inflammatory process and the location of appendix at times causes operative difficulties. It has also been associated with potential disadvantages like postoperative pain, wound sepsis and complications like intestinal obstruction which may delay recovery.11 With the development of laparoscopic technique, it has emerged as a modus operandi for both diagnosis and treatment of acute appendicitis.12 Studies have shown the procedure to be effective and with improved cosmesis, reduced postoperative pain, days of hospitalization and early return to work.13-17 Laparoscopic appendectomy was first reported in 19835 and has since been considered safe with high accuracy and complication rates as low as zero to 1.4%.18,19 Besides, laparoscopy preserves the option of leaving a macroscopically normal appendix. Safely in place, it also allows localization of the area of inflammation, making it possible to plan an incision if converting to open appendectomy, gives a better view to examine other peritoneal and pelvic organs, minimizing the chances of negative appendicectomy and missing other pathologies.20

Laparoscopic appendectomy has shown to be both feasible and safe in randomized comparisons with open appendectomy, 21 however local data on this subject is scarce. One published report from Pakistan reviewed 20 patients undergoing the procedure and compared their results with same number of patients operated with open technique. They looked in to the differences in elective cases only and showed similar results as we have in the emergency cases.22

All laparoscopic appendectomy in this study were performed by one consultant surgeon to limit technique bias. Different consultants performed the open appendectomy using Gridiron (73.3%) or Lanz (26.7%) incision. Mean operative time was 51.8 ± 7.8 minutes (45 to 90mins) for laparoscopic appendectomy and 39.6 ± 5.6 minutes (30-45 minutes) for open appendectomy. Alvarado scoring, our sample has relatively less number of gangrenous and perforated cases compared to simple acute ones. This can be considered as a weakness of this study.

Conclusion
The data from our study shows that laparoscopic appendectomy is as safe and effective as open appendectomy with lesser postoperative analgesia requirement and wound infections.

References
1. McBurney CN. The incision Made in the Abdominal Wall in Cases of Appendicitis, with a Description of a New Method of Operating. Ann Surg. 1894; 20:38-43.
2. Samelson SL, Reyes HM. Management of perforated appendicitis in children-revisited. Arch Surg. 1987; 122:691-6.
3. Editorial A. sound approach to the diagnosis of acute appendicitis. Lancet. 1987, 198-200.
4. Semm K. Endoscopic appendectomy. Endoscopy. 1983; 15:59-64.
5. Moberg AC, Berndrem F, Palmquist I, Petersson T, Resch T, Montgomery A. Randomised clinical trial of laparoscopic versus open appendicectomy for confirmed appendicitis. Br J Surg. 2005; 92:298-304.
6. Harrell AG, Licourt AE, Novitsky YW, Rosen MJ, Kuwada TS, Kercher KW, et al. Advantages of laparoscopic appendectomy in the elderly. Am Surg. 2006; 72:474-80.
7. Young JL, Law CM, Lo CY, Cam CM. A comparative study of routine laparoscopic versus open appendicectomy. JSLS. 2006; 10:188-92.
8. Sweeney KJ, Keane FB. Moving from open to laparoscopic appendicectomy. Br J Surg. 2003; 20:257-8.
9. Amir M, Raja MH. Timings for surgery of acute appendicitis. J Coll Physicians Surg Pak. 2000; 10:295-7.
10. Fingerhut A, Millat B, Borrie F. Laparoscopic versus open appendicectomy: time to decide. World J Surg. 1999; 23:835-45.
11. Hellberg A, Rudberg C, Kullman E, Enochson L, Fenyo G, Graffner H et al. Prospective randomized multicenter study of laparoscopic versus open appendicectomy. Br J Surg. 1999; 86:48-53.
12. Seymour I, Schwartz editor, principles of surgery, 7th ed. United State of America: Mc graw hill. 1996, 1386.
13. Lin HF, Wu JM, Tseng LM, Chen K, Huang SH, Lai LR. Laparoscopic versus open appendicectomy.