LAPAROSCOPIC VERSUS OPEN APPENDICECTOMY IN ADULTS. (STUDY OF 50 CASES)

Ketan Vagholkar\textsuperscript{a,*}, Swapnil Tople\textsuperscript{b,*} and Suvarna Vagholkar\textsuperscript{c,*}

\textsuperscript{a} Professor, \textsuperscript{b} Senior Resident, \textsuperscript{c} Research Assistant, * Department of Surgery. D.Y.Patil University School of Medicine. Sector 5, Navi Mumbai 400706. MS. India

ABSTRACT Background: Appendicectomy is one of the common procedures performed by a general surgeon. However, the advent of laparoscopic appendicectomy has reduced the number of open appendicectomies performed. Therefore there is a need to study the advantages of the laparoscopic approach over the traditional open approach. Aims: The study aimed to compare laparoscopic appendicectomy with open appendicectomy based on various intraoperative and postoperative parameters

Materials and methods: 50 patients undergoing interval appendicectomy were randomised into two groups. Group A comprised 25 patients who underwent laparoscopic appendicectomy and group B comprised 25 patients who underwent open appendicectomy. Results: Confirmation of diagnosis and evaluation of intraoperative findings was easier in group A patients. In addition, early commencement of feeds with early bowel movements, reduced need for postoperative analgesia due to less pain, lesser complications and shorter duration of hospital stay was observed in group A patients. Conclusion: Laparoscopic appendicectomy has better outcomes rendering it a preferable procedure for appendicectomy.

KEYWORDS Laparoscopic, Open, Appendicectomy, Outcomes, Complications.

Introduction

The first laparoscopic appendicectomy was performed in 1981 by Kurt Semm.[1] Forty years later, despite many retrospective studies and prospective clinical trials having been conducted, the role of laparoscopic appendicectomy as the gold standard for treating appendicitis is a debatable issue. The distinct advantages of the laparoscopic appendicectomy include greater diagnostic accuracy, especially in young women, and reduced postoperative pain and hospital stay with the shortest time to full recovery. [2] Nevertheless, the longer operating time, higher cost of the operation and difficulty in proving a real improvisation for an already safe and effective operation such as open appendicectomy have limited the routine use of this technique in the developing world.

Aims and Objectives

To compare laparoscopic appendicectomy with open appendicectomy based on evaluation of various parameters, which include:

1. Confirmation of diagnosis based on intraoperative findings
2. Intraoperative findings include adnexal pathologies, especially in females.
3. Operating time.
5. Commencement of bowel movements.
6. Duration of postoperative analgesia.
7. Postoperative complications.
8. Duration of hospital stay.

Materials and methods

Patients admitted to the hospital for interval appendicectomy with a confirmed diagnosis of obstructive appendicitis in a single surgical unit of D.Y. Patil Hospital and Research Centre Navi Mumbai, India, from January 2017 to December 2019 were included in the study. The total number of patients who were admitted for appendicectomy was 50. The duration of the study was 3 years.

The study protocol was approved by the institutional ethics committee prior to commencing the study.

Inclusion criteria

- All patients are undergoing interval appendicectomy above the age of 18 years.

Exclusion criteria

- All cases of acute appendicitis.
- Cases with lump formation.
- Patients in whom a laparoscopic procedure was converted to an open procedure.

The patients included in the study either had chronic abdominal pain or had a previous attack of acute appendicitis, which was treated conservatively. 6 weeks after the acute attack. These patients underwent a contrast-enhanced CT scan (CECT) of the abdomen. Findings suggestive of obstructive appendicitis on CECT were:

1. Non-visualisation of the appendix
2. Filling defects in the appendix
3. Partial visualisation of the appendix

The patients were admitted to the hospital a day prior to surgery. On admission to the hospital, a detailed proforma was completed, which comprised of the following:

1. History and physical examination findings.
2. Result of haematological investigations.
3. Results of radiological investigation.

Written informed consent was obtained from all patients with specific reference to the likelihood of conversion to an open procedure. Perioperative antibiotic protocol comprising of injection ceftriaxone (1 gram intravenously) pre, intra, and post-operatively was followed. Patients were randomised into 2 groups based on odd (group A) or even digit (group B) of the last indoor registration number. Group A comprised 25 patients, underwent laparoscopic appendicectomy and group B comprising 25 patients, underwent open appendicectomy. Parameters of outcome were:

1. Confirmation of diagnosis based on intraoperative findings.
2. Intraoperative findings, including adnexal pathologies, especially in females.
3. Operating time.
5. Commencement of bowel movements.
6. Duration of postoperative analgesia.
7. Postoperative complications.
8. Duration of hospital stay.

Surgical procedure

All operations were performed by a team headed by the first author. All laparoscopic procedures were performed under general anaesthesia.

Laparoscopic appendicectomy

A Foley’s catheter was placed in all cases before port placement to ensure decompression of the urinary bladder. A sub umbilical 10mm port was used for the telescope and camera. A right lower abdominal midline port of 5 mm and another 5mm port placed in the left lower abdomen were used for dissecting instruments. The appendix was identified and dissected free of adhesions. The mesoappendix was cauterized using bipolar coagulation till the base was reached. The base of the appendix was ligated with preformed chromic catgut end loops. The appendix was removed through the sub umbilical port after placing it in a plastic bag. All accessible pelvic and abdominal viscera were visualised to detect coexisting pathology, especially in females whose uterus and adnexal were evaluated. All patients were administered analgesia. Antiemetics were given only if a patient had vomiting. Patients were allowed oral feeds once bowel movements returned. They were discharged from the hospital after having passed normal stools.

Open appendicectomy

All open cases were done using either Mac Burney’s or Lanz incision. Pathology was confirmed after opening the peritoneal cavity. The appendix was identified, and the mesoappendix clamped, ligated and divided. The ovaries and fallopian tubes on the right side were examined. The incision was closed in layers.

Statistical methods

The SPSS statistical software version 19 was used for data analysis. Data were collected prospectively in patients who underwent open and laparoscopic appendicectomy. The Chi-square test was used to compare categorical (qualitative) variables. A p-value less than 0.05 was considered significant. Student t-test was used for comparison of continuous (quantitative) data.

Results

Laparoscopic appendicectomy was performed on 25 patients belonging to group A, and open appendicectomy was performed on 25 patients belonging to group B.

1. Age: In the present study, the mean age of patients was 22.6±4.7 years in group A and 23.5±9.7 years in group B.
2. Sex: Nine patients of group A and seventeen patients of group B were males, whereas sixteen patients of group A and eight patients of group B were females.
The introduction of laparoscopy into the field of surgery has long incisions, less need for analgesia, lesser scarring, and specific reference to morbidity statistics. [1] Avoidance of painful brought about a spectacular change in surgical outcomes with Discussion

10. Duration of hospital stay:

Operating time:

3. Commencement of bowel movements (Passage of stools):

Operating time in group A was 45.40±7.89 minutes, and in the group, B was 26.40±4.68 minutes. This observation was statistically significant (Table 2).

4. Commencement of oral feeds:

Commencement of oral feeds was done by 2.2±0.43 days in group A patients and by 3.08±0.70 days in group B patients. Oral feeds were started a day prior in group A patients compared to group B patients. This observation was statistically significant (Table 3).

5. Commencement of bowel movements (Passage of stools):

Commencement of bowel movements in group A was 2.32±0.467 days, and 2.52±0.58 days in group B. There was no significant difference in complete recovery of bowel movements in either group (Table 4).

7. Pain score and indications:

Post-operative pain was evaluated using the visual analogue scale (VAS). Group A patients had lower VAS scores than group B patients for all three days following surgery. This observation was found to be statistically significant (Table 5).

8. Duration of postoperative analgesia:

The duration of administration of postoperative analgesia in group A patients was 3.08±0.70 days, and 4.04±0.88 days in group B. Thus, the administration of postoperative analgesia was higher in group B as compared to group A. This observation was statistically significant (Table 6).

9. Postoperative complications:

Paralytic ileus was developed in two cases of group A and 3 cases of group B. Portal site infection developed in two cases of group A. Surgical site infection developed in one patient belonging to group B. However, the incidence of complication did not achieve statistical significance (Table 7).

10. Duration of hospital stay:

The duration of hospital stay in group A patients was 3.08±0.86 days and 6.64±1.07 days in group B patients. This observation was statistically significant (Table 8).

Discussion

The introduction of laparoscopy into the field of surgery has brought about a spectacular change in surgical outcomes with specific reference to morbidity statistics. [1] Avoidance of painful long incisions, less need for analgesia, lesser scarring, and shorter hospital stay have made laparoscopy a very popular option.[2] The present study studied two standard methods of performing appendectomy, viz. laparoscopic and the traditional open appendicectomy. Group A patients underwent laparoscopic appendicectomy, and group B patients underwent open appendicectomy.

The mean age of patients in group A was 22.6±4.7 years and 23.5±9.7 years in group B. Patients in both groups were young and did not have any comorbid disease. Hence age could not be considered an attributable factor for measuring the surgical outcome. Various studies revealed that the laparoscopic approach could safely be used across all age groups ranging from children to the elderly. [2,3] In children, laparoscopy confers the added advantage of avoiding longer incisions and reducing the pain associated with them.[2] Laparoscopy can still be a safe option in the elderly age group, wherein comorbid conditions exist. There is no significant increase in morbidity in elderly individuals.

In the present study, 64% of patients in group A and 32% in group B were females. Laparoscopy has a distinct advantage in the female population as adnexal pathologies closely mimic appendicitis in females can be diagnosed. Laparoscopy has an inaccurate edge diagnosis of adnexal pathologies, preventing an unnecessary appendicectomy. [3] Therefore, the laparoscopic approach reduces the chances of misdiagnosing appendicitis in general. Another advantage in the female population is the cosmetic outcome. The scars in laparoscopic surgery are hard to see, making it a preferable option. [3]

A pregnant state in a female patient challenges all the physiological organ systems of the body. Performing a surgical procedure during this period poses a great challenge as it involves risk to both the mother and foetus. [4,] In the present study, however, none of the females in either group were pregnant. However, various studies have revealed that laparoscopic appendicectomy can be safely performed in a pregnant state without causing any harm to the mother and foetus. [4, 5]

As is standard practice, a proper local visceral exploration was done in either of the groups. In open group B, the appendix was examined to confirm the pathology, followed by the ileocecal junction, ileum and ipsilateral adnexa in female patients. However, laparoscopy confers a great advantage as the entire abdomen, including the pelvis, can be visualised. [6, 7] Even contralateral adnexa in female subjects can be visualised. Therefore, laparoscopy has a great advantage for confirming the diagnosis prior to removal of the appendix. In the present study, a retrocecal position of the appendix along with adhesions was a common finding. Laparoscopy aids in dissecting a retrocecal appendix much faster and safer than the open method. [7] Proper positioning of the patient (head low with left-lateral) prior to commencing the dissection helps in better visualisation of the appendix by shifting the obscuring bowel loops. In the present study, it was found that the mean operating time in group A patients was 45.40±7.89 minutes as compared to group B patients, which were 26.40±4.68 minutes. Longer operating time in group A patients was attributable to proper insertion of the trocars followed by careful and meticulous dissection in a narrow area by laparoscopic technique. Laparoscopy limits manual dexterity during dissection as these instruments can be used in certain directions with certain angles. [7, 8] Open method allows better manual dexterity as the organ in question can be assessed from all sides. Any complications during open appendicectomy can be dealt with immediately, whereas, with the laparoscopic approach, it may at times pose a technical challenge, thereby prolonging the duration of the procedure. [6] In the present

**Table 1** Intraoperative Findings

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position of appendix</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrocaecal</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>Non-retrocaecal</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>Adhesions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Absent</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><strong>Status of appendix</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflamed</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Non-inflamed</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Other pathology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(P value > 0.05, not significant) (Chi-square test)

**Table 2** Operating time in minutes

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean(mins)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>45.40</td>
<td>7.895</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>26.40</td>
<td>4.682</td>
</tr>
</tbody>
</table>

(P value < 0.001, significant) Unpaired t-test

**Table 3** Commencement of oral feeds

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean(Days)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>2.24</td>
<td>0.436</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>3.08</td>
<td>0.702</td>
</tr>
</tbody>
</table>

(P value < 0.001, significant) Unpaired t-test

**Table 4** Commencement of bowel movements

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean (Days)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>2.32</td>
<td>0.476</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>2.52</td>
<td>0.586</td>
</tr>
</tbody>
</table>

(P value = 0.192, not significant) Unpaired t-test

**Table 5** Postoperative pain scores (VAS) on postoperative day 1, 2, 3

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VAS 1</strong></td>
<td>4.3±0.9(3-6)</td>
<td>5.6±0.6(5-7)</td>
</tr>
<tr>
<td><strong>VAS 2</strong></td>
<td>2.7±0.7(2-5)</td>
<td>3.8±0.8(3-5)</td>
</tr>
<tr>
<td><strong>VAS 3</strong></td>
<td>1.5±0.6(1-3)</td>
<td>2.4±0.7(1-4)</td>
</tr>
</tbody>
</table>

(P value < 0.05, significant) Unpaired t-test

**Table 6** Duration of post-operative analgesia in days

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean (Days)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>3.08</td>
<td>0.702</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>4.04</td>
<td>0.889</td>
</tr>
</tbody>
</table>

(P value < 0.001, significant) Unpaired t-test
Table 7 Post-operative complications

<table>
<thead>
<tr>
<th>Post-operative complications</th>
<th>Group A</th>
<th>Group B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paralytic Ileus</td>
<td>2(8.0%)</td>
<td>3(12.0%)</td>
<td>5(10.0%)</td>
</tr>
<tr>
<td>Port site infection</td>
<td>2(8.0%)</td>
<td>NA</td>
<td>2(4.0%)</td>
</tr>
<tr>
<td>Wound infection</td>
<td>NA</td>
<td>1(4.0%)</td>
<td>1(2.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

X²=1.087 DF=1 P value=0.297(Not significant) (Chi square test)

Table 8 Duration of hospital stay in days

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean (Days)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>3.08</td>
<td>0.862</td>
</tr>
<tr>
<td>B</td>
<td>25</td>
<td>6.64</td>
<td>1.075</td>
</tr>
</tbody>
</table>

(P value<0.001, significant) Unpaired t-test

In the present study, the duration of operating time was found to be statistically significant. This was consistent with other studies. [7, 8, 9]

Commencement of bowel movements after any surgical procedure depends upon the extent of handling of the bowel during a surgical procedure. Open surgery is associated with painful incisions and excessive handling of the viscera. This leads to slowing of the motility of the handled bowel giving rise to ileus. Laparoscopic surgery involves minimal bowel handling, and whatever handling is done delicately with instruments. [10] Hence, motility is not significantly affected. This enables the early commencement of oral feeds after a laparoscopic procedure. In the present study, oral feeds were commenced earlier in group A patients (2.24 days) than group B patients (3.08 days), which was statistically significant. Bowel movements also commenced early in group A (2.32 days) compared to group B (2.52 days) patients. The sample size being small, the observation did not achieve statistical significance. However, many other studies proved that laparoscopy continues to carry the advantage of early commencement of oral feeds and bowel movements compared to open surgery. [10,11]

In the present study, the severity was observed by the Visual Analogue Scale (VAS). The severity of pain was assessed on days one, two, and three. The severity of pain in group A was less than in group B for all three days. This proves beyond doubt that minimally invasive procedures are less morbid in the form of pain as compared to open procedures. This observation confers a significant advantage to the laparoscopic approach. [11, 12] As a result, the need for postoperative analgesia is less in the laparoscopic approach than in an open approach. Smaller incisions in punctures and minimal dissection with precise instruments significantly reduce the severity of pain. This also avoids the side effect of prolonged analgesics, especially in patients with peptic ulcer disease and renal impairment. [13, 14, 15]

The complications evaluated in the present study were paralytic ileus and surgical site infections. It was observed that the incidence of paralytic ileus was less in group A than in group B. This was because of minimal tissue handling of the bowel during operation. Similar results were observed in other studies. Port site infection continues to be a worrisome complication. It is most commonly seen at the umbilical port site. [12,13,16,17] In the present study, two patients in group A developed umbilical port site infection. However, none of these patients developed incisional hernia after 6 months of postoperative follow-up. The main challenges of managing port site infections are the nature of organisms causing it. [13,14,18,19] Resistant organisms such as MRSA and atypical mycobacteria are complicated to manage. Therefore, it is impossible to take utmost aseptic precautions, especially while removing the specimen and closing the port site incision. [15,16,19] Irrigation of the incision after closing the sheath with diluted hydrogen peroxide solution has proven very effective. However, more extensive study needs to be carried out to advocate this practice as a standard of care.

Duration of hospital stay is considered a function of the quality of surgical care. [19, 20] Laparoscopic procedures have surpassed open procedures in this respect. In the present study, the mean duration of hospital stay in group A patients was 3.08 days compared to 6.64 days in group B patients. This observation was statistically significant, confirming the distinct advantage of laparoscopy over an open procedure that has a dual advantage, both to the patient and the health care system. [20, 21] The study’s limitations are the smaller sample size and that only elective procedures were included in the study.

Conclusion

In conclusion, laparoscopic appendicectomy is superior to open appendicectomy. Meticulous and superior quality of dissection, less bowel handling leading to early recovery of bowel function, reduced pain requiring less postoperative analgesia, reduced chances of surgical site infections, cosmetically appealing incisions, and shorter stay in hospital make laparoscopic appendicectomy a beneficial procedure with increasing patient acceptability.

Acknowledgements

The authors would like to thank the Dean, D.Y.Patil University School of Medicine, Navi Mumbai, India, for allowing us to...
References


