A Comparative Study of Routine Laparoscopic Versus Open Appendectomy

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ABSTRACT

Objective: We evaluated the outcomes of routine laparoscopy and laparoscopic appendectomy (LA) in patients with suspected appendicitis. This is a retrospective study of the outcomes of patients undergoing laparoscopic appendectomy compared with outcomes for patients undergoing open appendectomy (OA) during the time that LA came into use.

Method: Results of patients managed with routine laparoscopy and LA for suspected acute appendicitis were reviewed and analyzed. The preoperative and intraoperative findings were recorded. The clinical outcomes were compared with those of patients undergoing OA in the preceding 10 months.

Results: During the LA study period, 97 patients (47 men) with the median age of 34 years (range, 18 to 79) presented with clinical features of acute appendicitis. With the exclusion of 5 patients with open operations and 10 patients with other pathologies, 82 patients underwent laparoscopic appendectomy (Group A) for appendicitis. Thirty-one (37.8%) patients had complicated appendicitis (perforated or gangrenous appendicitis). Conversions were required in 6 patients (7.3%). During the OA period, 125 patients (57 men) with the median age of 42 (range, 19 to 79) years were operated on. With the exclusion of 6 patients with other pathologies, 119 underwent OA for acute appendicitis (Group B). Fifty-one (42.9%) had either perforated or gangrenous appendicitis. The median durations of surgery in Group A and Group B were 80 minutes (range, 40 to 195) and 60 minutes (range, 25 to 260), respectively (P<0.005). Postoperative complication rates were comparable between the 2 groups (13.4% in Group A versus 15.8% in Group B). The median hospital stay for patients in Group A and Group B were 3.0 days (range, 1 to 47) and 4.0 days (range, 1 to 47), respectively (P=0.037).

Conclusion: We conclude that routine laparoscopy and LA for suspected acute appendicitis is safe and is associated with a significantly shorter hospital stay. Other intra-abdominal pathologies can also be diagnosed more accurately with the laparoscopic approach.

Key Words: Laparoscopic appendectomy.

INTRODUCTION

Appendectomy is one of the most commonly performed operations by general surgeons. For almost a century, open appendectomy (OA), first described by Charles McBurney in 1889, has remained the gold standard treatment for acute appendicitis. It is considered a safe, effective procedure with a low morbidity rate. Laparoscopic appendectomy was first described by Kurt Semm in 1983, and the application of the laparoscopic approach for acute appendicitis was first reported by Schreiber in 1987. With advances in technology and the surgical technique, laparoscopic appendectomy has become the novel alternative in the treatment of appendicitis in the last 2 decades. Despite the publications of numerous randomized trials, which compared open and laparoscopic appendectomy, the indications for laparoscopy in patients with suspected appendicitis remain controversial. Some studies failed to demonstrate clear advantages of LA over OA. No consensus exists as to whether laparoscopy should be performed in select patients or routinely for all patients with suspected acute appendicitis. In the present study, the outcomes of the policy of adopting laparoscopy routinely for patients with suspected acute appendicitis were retrospectively reviewed. A comparison was made with a historical group of patients who were treated with open appendectomy before the adoption of this policy.

METHODS

The policy of using laparoscopy in patients with clinical features of acute appendicitis was adopted in November
Five underwent open surgery because of a high medical risk with clinical features of acute appendicitis were operated on. Ninety-seven patients with clinical features of acute appendicitis were operated on. From November 2002 to April 2003, patients were routinely operated on in those with equivocal presentations. With the exclusion of these patients, laparoscopy was performed in 82 patients with acute appendicitis during that period (Group A).

Laparoscopy was performed by specialist surgeons with experience in laparoscopic procedures in other fields or under their close supervision. The patient was put under general anesthesia while in the supine position. Intravenous antibiotics were given at the induction of anesthesia. The peritoneal cavity was accessed using the open Hassan technique, and an 11-mm trocar was inserted at the subumbilical region for the telescope. Pneumoperitoneum was created by insufflation of carbon dioxide at a pressure of 12-mm Hg. Two additional trocars (usually 5 mm) were inserted at the lower quadrants of the abdomen. Dissection and mobilization of the appendix was performed with coagulation or ultrasonic dissector. The appendix was divided at the base between 2 Endoloops. Retrieval of the resected appendix was performed through the umbilical port, and the appendix was sent for histological examination.

Open appendectomy was performed from January 2002 to October 2002, and the operation was performed under the supervision of a specialist surgeon. During this period, 125 patients (mean age, 42; range, 19 to 93) who presented with suspected acute appendicitis underwent surgery. After excluding 6 patients with other pathologies (cecal diverticulitis: n=3; gynecological cause: n=1; cancer of the ascending colon: n=1; and small bowel perforation: n=1), 119 patients (Group B) with acute appendicitis underwent open appendectomy.

In this group of patients, a right lower quadrant muscle splitting incision was used in the majority of the situations. The mesoappendix was ligated and divided. The appendiceal stump was transfixed and invaginated using a purse-string suture. The incision was then closed in layers.

STATISTICS

All values are expressed as medians (range). Comparisons between groups were done using the chi-square test or Fisher’s exact test when applicable for nominal variables, and the Mann-Whitney test for continuous variables. Statistical analyses were performed using statistical software (SPSS 10.0 for Windows, SPSS Inc, Chicago, Illinois, USA). A 2-tailed test with P≤0.05 was considered statistically significant.

RESULTS

Comparisons of the patients’ demographics and clinical features in the 2 periods are summarized in Table 1. No

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**Table 1.**
Comparison of Patients Treated for Suspected Acute Appendicitis in the 2 Periods

|                      | Period 1 (N=125)* | Period 2 (N=97)* | P Value |
|----------------------|-------------------|------------------|---------|
| Male (%)             | 57 (46)           | 47 (48)          | 0.673   |
| Median age (years)   | 42 (19–93)        | 34 (18–79)       | 0.001   |
| Median WBC (×10³/L)* | 13.8 (2.85–28.1)  | 14.0 (5.10–30.5) | 0.199   |
| Median duration of pain (hr) | 24.0 (3.0–168) | 24.0 (4.0–330) | 0.119 |
| ASA ≥2 (%)*          | 36 (30.3)         | 28 (34.1)        | 0.815   |
| US or CT scan (%)*   | 18 (%)            | 17 (%)           | 0.526   |

*Period 1= open surgery for patients with suspected appendicitis; Period 2= laparoscopic surgery for patients with suspected appendicitis; WBC= white blood cell count; ASA= American Society of Anesthesiologist Class; US= ultrasound; CT= computed tomographic.

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differences were noted in sex, duration of pain, white cell count, and the use of imaging in the 2 periods.

Comparisons of patients in Group A and Group B are shown in Table 2. Thirty-one patients (37.8%) had complicated appendicitis with perforation or gangrenous changes in Group A, while 51 patients in Group B (42.9%) had perforated or gangrenous appendicitis. The median durations of operations for Group A and Group B were 80 minutes (range, 40 to 195) and 60 minutes (range, 25 to 260), respectively (P<0.005). The median preoperative length of hospital stay for Group A and Group B patients was 0 day (range, 0 to 2) versus 1 day (range, 0 to 2), respectively (P=0.007). Six patients in Group A versus 27 patients in Group B required convalescent care (P=0.004). Patients in Group A had significantly shorter median postoperative hospital stays (2 days; range, 0–24) as compared with that of Group B (3 days; range, 1 to 39). The median total length of hospital stay was 3.0 days (range, 1 to 47) and 4.0 (range, 1 to 47) in Group A and Group B, respectively (P=0.037) (Table 2).

Conversion

Conversion was required in 6 patients (7.3%) with complicated appendicitis in Group A. The reasons for conversion included extensive peritonitis in perforated appendices including an appendiceal mass in 4 cases, difficult dissection in 1 patient, appendix not identified in 1 patient. The median total length of hospital stay for the conversion group was 5.5 days (range, 5 to 24) versus 3 days (range, 1 to 23) for the nonconversion group, P=0.001. The conversion group, however, did not have increased morbidity, 1 (16.7%) versus 10 (10.9%), P=0.671.

Complications

No operative mortalities or intraoperative complications were attributed to laparoscopy. The overall complication rate was 14.8% (27/196). Four (4.9%) patients in the laparoscopic group suffered from intraabdominal abscesses, which required readmission. One was treated with open drainage, and the others were successfully treated by CT-guided percutaneous drainage. They subsequently made an uneventful recovery and were discharged from the hospital. The wound infection rates were 3.66% (3/82) and 5.04% (6/119) in the laparoscopic and open groups, respectively. Two patients (1.68%) from the open group suffered from pneumonia but none was reported in the laparoscopic group. The overall complication rate in Group A (13.4%) was comparable to that of Group B (15.8%) (Table 3). Two patients in Group B required readmission for epigastric pain and intestinal obstruction, respectively. Both were treated conservatively. Compared with Group A, the readmission rate was not significantly different (P=0.679).

DISCUSSION

Acute appendicitis is one of the most commonly encountered surgical conditions that requires emergency surgery. Early diagnosis with prompt surgery is the preferred treatment option to prevent complications, such as perforation that can lead to an increase in morbidity. However, this would lead to a great deal of unnecessary appendectomies and has been the center of debate. Moreover, thorough examination of the peritoneal cavity is not possible with the conventional right iliac fossa incision. Laparoscopic surgery is a major surgical advance in the last 2 decades, and it enables shorter hospital stay and faster recovery. Laparoscopy has become the preferred surgical...
approach for gallbladder disease and gastroesophageal reflux disease. Laparoscopic appendectomy has gained popularity and is believed to have the same advantages, both in diagnostic and therapeutic value.

In this study, the change in the operative approach in patients with suspected appendicitis is shown to be safe and effective. The laparoscopic skills of experienced laparoscopic surgeons can be transferred to a different operation without increasing the patients’ morbidity. Laparoscopy can be performed in 94.8% of patients with suspected appendicitis. Despite the fact that the incidence of complicated appendicitis was 37%, the conversion rate was only 7.8%, which is comparable to the results of other studies.9–11 The operating time is longer with the laparoscopic approach, and this reflects the learning curve of the procedure. No intraoperative complication led to morbidity or conversion. The use of preoperative imaging for diagnosis of equivocal cases was similar in the 2 periods. Thus, although the preoperative stay was shorter in the laparoscopy period, laparoscopy did not reduce the need for imaging in patients with equivocal presentations.

In this study, the presentations of the patients with suspected appendicitis were similar in the 2 periods, and no differences existed in the duration of pain or the white cell counts of patients in the 2 periods. With the exclusion of patients with pathologies other than appendicitis, the incidence of morbidity was similar in the open or laparoscopic approach. The overall complication rates were similar in the 2 groups of patients. However, the median hospital stay was significantly shorter in the laparoscopy group. There was no difference in terms of wound complications, and conversion did not lead to a higher wound complication rate. The occurrence of intraabdominal abscess is higher in those patients undergoing laparoscopy. This finding is consistent with findings in other studies.9,11 The increase in the incidence of intraabdominal abscess shown in the present study confirmed the findings in a metaanalysis that demonstrated increased, though not statistically significant (OR=1.94, 95% CI 0.68 to 5.58, P>0.05) intraabdominal abscess in patients who underwent laparoscopic appendectomy.12 In the recently published analysis of 54 studies on laparoscopic appendectomy by the Cochrane group, the incidence of intraabdominal abscesses was increased (OR=2.48, CI 1.45 to 4.21) in patients who underwent laparoscopy.13 Cuschieri postulated that the increase in intraabdominal pressure might contribute to the diffusion of infection.14 Moreover, the proportion of patients with complicated appendicitis is higher in the present study when compared with that in other studies on laparoscopic appendectomy.15,16 The learning curve period might also account for the high number of intraabdominal abscesses.

Patients who underwent laparoscopic appendectomy had significantly longer operating times than did those having open surgery. This could be attributed to the inclusion of the patients in the study who were undergoing operations within the early phase of the learning curve. According to other studies,17 this difference tends to drop as the laparoscopic operative experience improves, which in turn may reduce the complication rate. Length of hospital stay was significantly shorter in the laparoscopic group. Some authors15 argue that the appendiceal pathology was a major determinant of length of hospital stay. Patients with gangrenous or perforated appendicitis were most likely to require an extended hospital stay. These patients are sicker and required an extended hospital stay regardless of the surgical technique used. Admittedly, our study was not a randomized trial, and a bias towards early discharge of patients undergoing LA might contribute to the shorter hospital stay in the laparoscopic group. However, the study was carried out within a short period of time, and there were no significant changes in the postoperative management. The incidence of complicated appendicitis was similar in the 2 groups, and the short hospital stay is likely to be due to the use of a different surgical approach.

CONCLUSION

We conclude that the change in the surgical approach to manage suspected appendicitis is safe and effective. Although the operating time is longer in laparoscopic appendectomy, our conversion rate was comparable to that of other centers, and there was no intraoperative morbidity. The overall morbidity was similar to that of open surgery. However, the incidence of intraabdominal collection is higher in those undergoing laparoscopy. The advantages of laparoscopic appendectomy seem to be mainly related to the improved diagnostic ability and shorter hospital stay.

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