www.jmscr.igmpublication.org
Index Copernicus Value: 79.54
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v7i3.100

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Article

Decreased Surgical Complications in Laparoscopic acute Appendicitis (Complicated vs Uncomplicated)

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Abstract
Objectives: *postoperative surgical complications of sepsis in patients are debated with complicated acute appendicitis treated with laparoscopic appendectomy (LA).*
The aim of this study was to investigate the results of LA in both complicated and uncomplicated cases of acute appendicitis.
Methods: *From December 2016 to December 2018, 80 patients with acute appendicitis underwent LA by the same surgery team using the three-port technique. Data were collected and compared between complicated and uncomplicated acute appendicitis.*
Results: *Of the 80 patients (35 were women and 45 are men), 58 were uncomplicated and 22 are complicated acute appendicitis. The group with complicated acute appendicitis, as compared to the uncomplicated group, was significantly older (60 to18.5 years vs. 41.0 to 18.0 years), and had a significantly increased operation time (117 - 50 minutes vs. 90 - 50 minutes),longer length of hospital stay (12- 4 days vs. 5- 6.0 days) and higher conversion rate(25% vs. 3%). No increase in surgical complications were noted in the patients with complicated acute appendicitis, as compared to those with uncomplicated acute appendicitis.*
Conclusion: *This study demonstrated no increase in surgical complications after LA in patients with complicated acute appendicitis when compared with those who had uncomplicated disease. Therefore, LA may be considered the first-choice treatment option for both uncomplicated and complicated acute appendicitis.*

Introduction

Laparoscopic appendectomy (LA) has been an increasingly used surgical procedure for acute appendicitis since its introduction in 1983.[1] Although not yet established as the standard method for treatment of acute appendicitis, it provides better diagnostic accuracy, reduced use of analgesics, shorter hospital stay, earlier return to daily activities, day care surgery and a lower rate of wound infection in comparison to open appendectomy (OA).[2e7] Some investigations have also revealed that elderly patients, morbidly obese patients, comorbid patients and fertile women can take advantage of LA to treat acute

appendicitis.[8e11] In addition, LA is cosmetically beneficial, can aid in the development of a surgeon's laparoscopic skills, and is cost-effective.[12]

However, there is a debated issue regarding septic postoperative complications (e.g., intra-abdominal abscess) following LA, especially in cases with complicated appendicitis.[13e16] Although some studies have concluded that LA is a safe and effective treatment for complicated acute appendicitis,[17e20] undesirable short-term results including prolonged operation time and postoperative stay, increased rate of conversion, unskilled hands and greater complications due to infection have been reported when compared to uncomplicated appendicitis. Thus, some surgeons are hesitant to perform LA in those patients in whom they suspect complicated appendicitis. Therefore, the aim of this study was to investigate the feasibility of LA in cases of complicated acute appendicitis and its surgical complications

Patients and Methods

Data were collected and recorded from 80 patients who had consecutively undergone treatment for acute appendicitis bya single senior surgeon team in king George hospital vishakapatnam from December 2016 to December 2018. The diagnosis of acute appendicitis was made by preoperative clinical presentation .Acute appendicitis was defined in which the appendix became inflamed with or without pus formation, causing pain. Laparoscopy was performed with the three-port approach (two10 mm, one 5 mm) using Hasson's technique with monopolar dissectors and forceps. The meso appendix was divided using electrocautery or clips. Pre-tied suture loops or laparoscopic free ties were used for stump closure. The appendix was extracted within the trocar via the umbilical 10-mm port without using a plastic bag. Gangrenous and ruptured appendices were irrigated with normal saline (at least 2000 mL), and a silastic drain was used for ruptured appendices. If the patient's anatomy impeded the laparoscopic procedure, conversion to open appendectomy was performed through a low midline incision, following the conventional approach. Patient follow-up occurred at least once in the outpatient clinic after discharge. Data collected included demographic records, white blood cell (WBC) count, operation time, length of hospitalization, pathology report, and complications. These parameters were compared between complicated and uncomplicated cases of acute appendicitis. The c2 and t testwere used; a p value < 0.05 was considered significant.

Results

The study included 35 women (43.75%) and 45 (56.25%) men (mean age: 45 - 18.2 years) who were preoperatively diagnosed with acute appendicitis. Of the 80 patients, 22(27.2%) had complicated acute appendicitis, and 58 (72.8%) uncomplicated acute appendicitis. All patients underwent routine laparoscopic surgery, but four (5%) of the patients required conversion to open appendectomy after laparoscopy, due to anatomical difficulties encountered during LA. With regard to the pathology reports, 18 (22.2%) of the patients had ruptured acute appendicitis, and 62(77.3%) had simple acute appendicitis. Thus, the accuracy of diagnosis based on pathology reports was 74.5% (59/80). In this study, only 12 patients received preoperative computed tomography (CT). Among them, acute appendicitis was confirmed by pathologist in 10 patients. A comparison of complicated and uncomplicated cases of acute appendicitis initially treated by LA is given in Table 1.Both groups were comparable regarding sex, duration of symptoms, WBC count, and surgical complications. In contrast, the complicated acute appendicitis group had significantly longer operation times and length of hospital stay, a higher conversion rate, and was most commonly old age. The mean operation time for LA for ruptured acute appendicitis was 112 minutes and 74 minutes for simple acute appendicitis. The mean length of hospital stay after LA for ruptured acute appendicitis was 9 days and 5 days for

simple acute appendicitis. One patient received converted open appendectomy for uncomplicated acute appendicitis and had a length of stay of five weeks due to postoperative intra abdominal abscess superimposed on poor compliance with old age and other co-morbidities like hypertension and diabetes.

None of the patients with complicated acute appendicitis had surgical complications, but four (5.0%) patients with uncomplicated acute appendicitis sustained surgical complications (2 intra-abdominal abscesses, 1wound infection, and 1 liver abscess). This paradoxical result may be attributed to the higher conversion rate (18.1%, or 4/22) in patients with complicated acute appendicitis than in those with simple acute appendicitis (3.7%, or 2/58).Comparisons between patient who underwent LA versus Open Appendicectomy (converted) are summarized in Table 2. The COA group had a significantly longer duration of symptoms and operation times and had more patients with complicated acute appendicitis, who were significantly older. In fact, 66.7% (four out of six) of the patients in the COA group had complicated acute appendicitis. There was no significant difference in sex, WBC count, and length of hospital stay between the two groups. Regarding surgical complications, there were two of fifty eight (3.4%) patients with an intra-abdominal abscess, and one (1.1%) with a wound infection, and one (1.1%) with liver abscess in the LA group. In the COA group, one of six (16.7%) patients suffered from intra-abdominal abscess. However, overall, there was no significant difference in the rate of surgical complications between the two groups. All complications resulting from infection were successfully treated with administration of intravenous antibiotics.

Table 1 Comparison between complicated and uncomplicated acute appendicitis initially treated by laparoscopic appendectomy

Factor	Complicated	Uncomplicated	p value
Sex	14:9	35:31	0.281
Age	58.2 ± 18.5	45.2 ± 20.1	0.003
Duration of symptoms (d)	3.7 ± 1.8	2.1 ± 1.3	0.096
WBC (10^3/L)	14.2 ± 3.6	13.6 ± 4.1	0.726
Operation time (min)	117.4 ± 45.3	81.2 ± 39.2	0.0
Length of hospital stay (d)	9.2 ± 5.1	6.2 ± 5.1	0.009
Surgical complications	0	4	0.203
Conversion rate	4/22 (21.1%)	2 / 58 (27.5%)	0.003

Discussion

Although septic postoperative complications following LA for acute appendicitis still pose a problem, in the present study, there was no significant increase in the rate of surgical complications in patients with complicated versus uncomplicated acute appendicitis. In fact, there were no surgical complications in patients with complicated acute appendicitis, but four (5.0%) of the 58 patients with uncomplicated acute appendicitis sustained surgical complications. We believe that these paradoxical results were due to the higher conversion rate in patients with complicated acute appendicitis, which prevented further surgical complications. Although some authors have argued that aggressive manipulation of the infected appendix and increased use of irrigation fluid may increase the risk of contamination of the peritoneal cavity during LA,[21] we found that irrigation of the gangrenous and ruptured appendices with normal saline during LA did not result in an increased rate of intra-abdominal abscess formation. This observation was consistent with a study demonstrating that peritoneal lavage with 3 L 0.9% saline during LA for perforated appendicitis does not lead to increased postoperative intra-abdominal abscess formation.[22] Therefore, we suggest that irrigation

with copious amounts of solution during LA is feasible, even in cases of complicated acute appendicitis, which may contribute toa more favorable surgical outcome. In addition, copious peritoneal lavage may also be helpful for uncomplicated acute appendicitis, particularly when iatrogenic rupture of appendix happens during the operation. Significantly longer operation times and a prolonged hospital stay are major concerns when dealing with complicated acute appendicitis treated by LA, because skill ful and meticulous laparoscopic techniques are required to address the inflammatory changes related to adherence. Of note, there were only 12 patients who received preoperative CT in this study. Among these, acute appendicitis was confirmed bya pathologist in 10 patients. With associated CT, the accurate diagnosis of acute appendicitis is higher and it may help us to evaluate the relevant anatomical structure, particularly in those who sustain suspected complicated acute appendicitis. Therefore, implementation of CT may help us to determine which patients can be managed successfully by LA, thus decreasing the conversion rate in those who have complicated acute appendicitis. However, the correlation of CT findings with complicated or uncomplicated acute Laparoscopic appendectomy for complicated acute appendicitis to surgical procedure was beyond the scope of the present study. In the present study, the mean operation time for complicated and simple acute appendicitis by LA was 118 minutes and 78 minutes, respectively. If conversion was required, the mean operation time increased to 145 minutes. In addition, the mean length of hospital stay after LA for ruptured acute appendicitis was 9 days and 5 days for simple acute appendicitis. If conversion was required, the mean length of hospital stay increased to 18 days, although this increase was not significant, due to high variation in COA patients. Although a longer operation time and prolonged hospital stay were expected following treatment of complicated acute appendicitis by LA, a comparison of the results between the traditional open method and LA for complicated acute appendicitis was beyond the scope of the study design.

In the present study, the overall conversion rate was 6.38%, which was comparable to the rate in other studies[19,20]; the conversion rate for complicated and uncomplicated acute appendicitis groups was 25. 1% and 3,2%, respectively. A higher conversion rate was noted in nearly 20% of the patients with complicated acute appendicitis; however, no significant increase in the rate of surgical complications was noted. A surgeon's experience has been shown to correlate with the rate of conversion to open procedures.20 In the present study, all procedures (LA and COA) were performed by the same senior surgeon, thus making the comparison more meaningful. The benefits of treating complicated acute appendicitis with LA include wide inspection of the peritoneal cavity, debridement, irrigation, and lavage under direct visualization, avoidance of large abdominal incisions, and fewer pulmonary complications.23 Another benefit of LA is that diagnostic laparoscopy can be performed before the actual open appendectomy in doubtful cases.24 It is undecided whether LA has an immunological advantage in cases of complicated appendicitis; however, our WBC count data did not reveal any significant difference between the subgroups, which is consistent with other reports that indicate no differences in inflammatory parameters after LA for non perforated appendicitis.[25] Therefore, in accordance with other studies that have proposed the feasibility of LA for treating complicated acute appendicitis, we propose that LA should be considered as the first intervention, not only for uncomplicated but also for complicated acute appendicitis. Our study demonstrated that using LA to treat complicated acute appendicitis was not associated with additional surgical complications when compared with those who had uncomplicated acute appendicitis. Therefore, it seems feasible to use LA as the first-choice treatment for both uncomplicated and complicated acute appendicitis.

Table 2: Comparison between LA and Open in acute appendicitis.

Factor	Complicated	Uncomplicated	p value
Sex	45:38	2:1	0.924
Age	44.31 ± 18.2	45.2 ± 20.1	0.003
Duration of symptoms (d)	2.97 ± 1.21	11.2 ± 5.6	0.003
WBC (10^3/L)	14.24 ± 4.2	12.4 ± 5.6	0.367
Operation time (min)	85.4 ± 41.24	130.02 ± 51.78	0.000
Length of hospital stay (d)	6.29 ± 5.1	21.12 ± 10.12	0.151
Complicated acute appendicitis	15/76 (18%)	4/4 (66.7%)	0.003
Surgical complications	5/76	1 / 4	0.287
Intra-abdominal abscess	2/76 (3.4%)	1 / 4 (16.7%)	0.120
Wound infection	1/76 (1.1%)	0/4 (0%)	0.793
Liver abscess	1/76 (1.1%)	0/4 (0%)	0.793

Statistically significant, COA – converted open appendectomy ; LA – Laparoscopic appendectomy

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