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Original Article

LAPAROSCOPIC *VERSUS* OPEN APPENDECTOMY - WHICH ONE IS BETTER ?

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Abstract

Objective: Appendectomy, being the most common surgical procedure performed in general surgery, is still being performed by both open and laparoscopic methods due to a lack of consensus as to which is the most appropriate method. Because further trials are necessary and few such studies have been performed in developing countries, we decided to evaluate the outcomes of the 2 procedures to share our experience with others.

Methods: Prospectively collected data from 618 consecutive patients with appendicitis were studied. These comprised of 340 patients who underwent conventional open appendectomy and 260 patients treated laparoscopically & 18 were excluded because of protocol violations. The two groups were compared with respect to operative time, length of hospital stay, postoperative pain, return to normal work, complication rate and cost.

Results: There were no statistical differences regarding patient characteristics between the two groups. Conversion to laparotomy was necessary in 5 patients (1.88%). Laparoscopic appendectomy was associated with a shorter hospital stay (1.5 d *vs* 2.5 d), lower incidence of wound infection (3.07% *vs* 8.29%,) & less analgesia requirement. The operative time was more (45.6 vs 24.5 min) and the cost of treatment was higher in the laparoscopic group.

Conclusion: The laparoscopic technique is a safe and clinically beneficial operative procedure. It provides certain advantages over open appendectomy, including short hospital stay, decreased requirement of postoperative analgesia, early food tolerance, and earlier return to normal activities. Where feasible, laparoscopy should be undertaken as the initial procedure of choice for most cases of appendicitis.

Introduction

Appendicitis is one of the most common surgical emergencies requiring appendectomy, with a life-time risk of 6%[1]. The overall mortality rate for open appendectomy (OA) is around 0.3% and morbidity about 11%.[2] Open appendectomy has been the treatment of choice for more than a century since its introduction by McBurney in 1894, and the procedure is standardized among surgeons[3]. Kurt Semm was the first to describe laparoscopic appendectomy (LA) in 1983. Encouraged by the success of laparoscopic cholecystectomy, which has become the gold-standard treatment for gallstone disease in a short span of time, laparoscopic surgery has gained in popularity and found application in almost every surgical speciality. Laparoscopic appendectomy has been shown to be feasible and safe in randomized comparisons with open appendectomy[4]. Laparoscopic appendectomy has improved diagnostic accuracy along with advantages in terms of fewer wound infections[5], less pain[5,6], faster recovery and earlier return to normal activity[5-7]. On the contrary, laparoscopic appendectomy consumes more operating time[5,6] and is associated with increased hospital costs[7].The laparoscopic approach has been supported as an alternate to open appendectomy by many comparative studies[8]. Some studies failed to

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demonstrate clear advantages for laparoscopic over open appendectomy[9,10]. No consensus exists as to whether laparoscopy should be performed in selected patients or routinely for all patients with suspected appendicitis. The idea of minimal surgical trauma, resulting in significantly shorter hospital stay, less postoperative pain, faster return to daily activities, and better cosmetic outcome has made laparoscopic surgery for appendicitis very attractive.

Patients and Methods

This prospective comparative study was performed in the Department of Surgery BSMMU & some private clinics in Dhaka city, from June 2004 to May 2010. All patients between 12 and 60 years of age admitted with a clinical diagnosis of appendicitis and those who completed follow-up were included in the study. All those patients in whom a clinical diagnosis of appendicitis was not established or had a palpable lump in the right lower quadrant, suggesting an appendicular abscess/mass and those who did not give consent were excluded from the study. Patients were fully informed about the risks and benefits of the 2 procedures. The qualifying patients were randomized into 2 groups, laparoscopic group (LA) and open group (OA), for treatment purposes. Informed written consent was obtained from every study subject, and data were collected in a specifically designed proforma where the patient's demographic details, operative findings, doses of analgesic, operative time, hospital stay, and postoperative complications were recorded.

Patients were diagnosed on a clinical basis with a history of right lower quadrant pain or peri umbilical pain migrating to the right lower quadrant with nausea, vomiting, fever of more than 38°C, right lower quadrant muscles guarding, and tenderness on physical examination and/or leukocytosis above 10 000 /cu mm, Ultrasonogram findings. Patients who had pathology other than appendicitis per-operative were excluded from the study at the begining. Data were recorded on case-record forms, and the study was monitored according to good clinical practice.

Surgical Procedure

All operations were performed with the patient under general/spinal anesthesia by first three authors who are experienced enough to perform standardized open and laparoscopic techniques.

A standard 3-port technique was used for laparoscopic appendectomy by the open (Hasson) /closed method for establishing pneumo peritoneum. Laparoscopic appendectomy was performed under GA with the patient in supine and steep Trendelenberg position. The surgeon stands on the left of the patient with the monitors at the foot end. Through 10 mm Umbilical port, telescope is introduced and a complete survey of the peritoneal cavity is performed. Two additional 5mm ports are introduced under vision. 2nd port, 5mm just above the symphysis pubis in the midline and 3rd port, 5 mm in the left iliac fossa. For better visualization of the operative field Trendelenberg position is maintained with left tilt of the table.

The mesoappendix was dissected by using electrocautery / ligated by 2/0 vicryl, and the appendix base was tied and divided between 2 endo-loops (Ethicon, UK) with laparoscopic scissors. An extraction bag was used to retrieve the specimen.

Open appendectomy was performed through a gridiron / lanz incision in standard fashion. The mesoappendix was ligated, and the appendix was divided at the base and removed without invagination. All specimens were sent intact for microscopic examination. All patients received a standard perioperative antibiotic regimen of intravenous cefuroxime/ciprofloxacin and metronidazole.

Laparoscopy was converted to open appendectomy if technical difficulties, uncertain anatomy, Or uncontrolled bleeding were encountered. Appendectomy was performed in macroscopically normal-looking appendix in both groups.

Postoperative Course

Bowel sounds were checked every 12 hours which usually appeared within 24 hours. Once bowel sounds were present, patients were allowed to take a habituated clear liquid diet and advanced to a regular diet when the liquid diet was tolerated and flatus was passed. Patients were discharged when they tolerated a regular diet and were afebrile for 24 hours.

Outcome Parameters

Clinical outcomes were recorded in proforma regarding total operative time, hospital stay, and time to resume oral intake. Dosages of parenteral and oral analgesics required were recorded by the data collector blinded to the type of operation. A standardized postoperative pain regimen was given to all and included

acetaminophen (paracetamol) 500 mg tablets, shots of diclofenac sodium, tramadol HCl & ketorolac tromethamine. Return to normal activity was recorded as time taken to resume work and other activities of social life. Patients were observed for developing any complications in postoperative period.

Follow-up

Patients were advised to attend outpatient clinic at weekly intervals for 3 weeks. Stitches were removed on the first week, and patients were observed for development of any complications on the second and third week appointments. Patients were advised to report for development of any complications and were followed for up to 10 months.

Results

Of 618 patients enrolled in this study, 18 were excluded because of protocol violations where 5 patients were converted to open appendectomy and 13 did not complete their follow-up. Reasons for conversion from laparoscopic to open appendectomy in 5 cases were a gangrenous appendix and inflammatory adhesions making access to the appendix difficult.

Mean age of patients in this study was 25.7 years in the laparoscopic group and 28.6 years in the open appendectomy group. No significant demographic differences existed between the 2 randomized groups in relation to age, sex, and leucocyte count, as summarized in Table-I.

Table-I

Characteristics	Laparoscopic Appendectomy (n = 260)	Open Appendectomy (n = 340)
Age (Years)	25.7	28.6
Sex		
Male	122 (46.9%)	185 (54.4%)
Female	138 (53.1%)	155 (45.6%)
White Blood Cell Count ($\times 10^9$ /L)	13.4	13.9

Operating time

In our study, the mean operative time of 45.6 minutes for the laparoscopic group was longer than the mean operative time of 24.5 minutes for open appendectomy, and this difference is statistically highly significant. Mean time to complete the diagnostic laparoscopy was 9 minutes (range, 3 to 45) in the laparoscopic group.

Analgesia

The laparoscopic group required fewer doses of parenteral and oral analgesics in the operative and postoperative periods compared with the open appendectomy group as summarized in table-II.

Table-II

Comparison of operative and post operative events between two groups

	Laparoscopic Appendectomy (n =260)	Open Appendectomy (n = 340)
Postoperative Subjective Outcome		
Operative time (min)	46.5	24.5
Parenteral analgesics (doses)	1.3	2.4
Oral analgesics (doses)	2.6	5
Time to oral intake (hrs)	18.2	22.3
Hospital stay (d)	1.5	2.5
Return to normal activity (d)	10.5	12.5
Postoperative Complications		
Paralytic ileus	9(3.46%)	35(10.29%)
Wound infections	8(3.07%)	18(5.29%)
Wound dehiscence	0	2
Intra-abdominal abscess	2	0
Small bowel obstruction	0	3
Cardiopulmonary complications	2	2
Total %	21(8.07%)	60(17.64%)

Oral Intake

Time taken to tolerate oral intake was significantly less in the laparoscopic group with mean 18.2 hours compared with mean 22.3 hours in the open group.

Hospital Stay

Hospital stay was significantly shorter in the laparoscopic group with a mean 1.5 days compared with a mean 2.5 days for the open group.

Activity

A highly significant difference existed between the 2 groups in time taken to return to routine daily activities, which was less in the laparoscopic group with a mean

10.5 days compared with mean 12.5 days in the open appendectomy group.

Complications

In this study, the overall incidence of complications was greater in open surgery than in laparoscopic surgery. A total of 21 complications occurred in the laparoscopic group, while 60 complications occurred in the open appendectomy group. Paralytic ileus was the complication with a statistically highly significant difference. Wound infection rate was greater in the open group than in the laparoscopic group, but statistically it was not significant. Differences in other complications like wound dehiscence, intra abdominal abscess, and small bowel obstruction were not significantly different .

Discussion

Appendicitis is one of the most commonly encountered surgical conditions that requires emergency surgery. Laparoscopic surgery is a major surgical advance in the last 2 decades.

Meta analyses[11,12] have confirmed that laparoscopic appendectomy is safe and results in a faster return to normal activities with fewer wound complications, at the expense of longer operating time. The perception also exists in many quarters that laparoscopic appendectomy has marginal advantages and may not be worth the trouble[13].Because no consensus has been reached, both procedures are still being practiced actively despite randomized trials and meta analyses. The subject still needs additional comparisons. This prospective comparative study was carried out to compare the postoperative outcomes of both procedures in histologically proven acute appendicitis.

Total operative time in this series was significantly longer in the laparoscopic group (mean 45.6 minutes) including 9 minutes consumed during diagnostic laparoscopy than in the open group (mean 24.5 minutes), which was measured as actual skin-to-skin time. Our finding is in agreement with other studies showing the same results[5,6,10]. This may be due to additional steps of operation like setup of instruments, insufflation, and making ports in laparoscopic surgery and diagnostic laparoscopy. Laparoscopic operating time should improve with increasing experience. Longer operating room times & machine cost result in higher costs that can be compensated by shorter hospital stay. Several other randomized studies[5-7,14-16] suggest this advantage by demonstrating quicker time to recovery and return to normal activity, whereas other studies have refuted this advantage[10,17].

Length of hospital stay is a very important variable that directly influences the economy and well-being of the patient. Our study shows a significant short hospital stay (1.5 days) in the laparoscopic group compared with that in the open group (2.5days). The results of this study are consistent with that of other published articles[18,19] that demonstrated a significantly short hospital stay. Total analgesic requirement is a quantitative method of recording the postoperative pain in various procedures. The majority of patients in this study failed in responding to the various scales/ response sheets for severity of pain. Therefore, the total number of postoperative analgesic doses required by individual patients was used to compare the analgesic requirement between the 2 groups. In this series, total parenteral and oral analgesic requirements were less in the laparoscopic group [parenteral 1.3 (range, 1 to 3); oral 2.6 (range, 2 to 4)] than in the open appendectomy group [parenteral 2.4 (range 2 to 5); oral 5.0 (range 2 to 8)], and this difference is statistically significant. Our finding is in agreement with findings of many other studies[5,14,20] that demonstrate less pain and less analgesic requirements in laparoscopic groups.

Some studies have shown significantly less time to tolerate oral intake in laparoscopic groups[21] compared with open groups. In this study, significantly less time was needed for patients to tolerate oral intake with a mean18.2 hours in the laparoscopic group compared with a mean 22.3 in the open group. In this study, mean time to full recovery i.e. time to resumption to work, was 10.5 days (range, 8 to 15 days) days in the laparoscopic group and 12.5 days (range, 10 to18 days) days in the open appendectomy group . This result is consistent with a similar study by Hellberg et al[6] that demonstrates median time to full recovery as 13 days in the laparoscopic group and 21days in the open group and other randomized clinical trails and meta-analysis[14]. However, other studies[17,19,22] show no difference with respect to performance of daily activities and time to full recovery. Generally, there are more expectations to resume work earlier after appendectomy, especially after laparoscopic appendectomy. These expectations make some sense, because laparoscopic procedures being minimally invasive should allow a short hospital stay, quicker recovery, and earlier return to work. Our

population group being a lower income group wanted to resume work earlier; therefore, we thought it would be a more reflective end point. Laparoscopic appendectomy has been attributed to a low incidence of complications compared with open appendectomy by many studies[11,12,28]. Our study is also in agreement with these studies, demonstrating 60 complications in open appendectomy versus 18 in the laparoscopic group. Wound infections may not be serious complications per se but represent a major inconvenience to the patient, impacting his or her convalescence time and quality of life. The majority of studies[2,12,14,29] have concluded that wound infections are significantly lower after laparoscopic appendectomy. In our series, 8 patients (6.3%) in the laparoscopic group and 18 (13.7%) in the open group had port/ wound infections. Wound infections were more common in the open group. One study[22] shows no statistically significant differences in infectious complications between the laparoscopic and open group.

Intra abdominal abscess formation is a serious complication and can potentially be life threatening. The occurrence of intra-abdominal abscess is higher in those patients undergoing laparoscopy. This finding is consistent with findings in other studies[23,24]. The increase in the incidence of intra-abdominal abscess shown in the present study confirmed the findings in a meta analysis that demonstrated increased intra-abdominal abscess in patients who underwent laparoscopic appendectomy[25]. In the recently published analysis of 54 studies on laparoscopic appendectomy by the Cochrane group, the incidence of intra-abdominal abscesses was increased in patients who underwent laparoscopy[26]. Cuschieri postulated that the increase in intra-abdominal pressure might contribute to the diffusion of infection[27]. The learning curve period might also account for the high number of intra-abdominal abscesses.

It is encouraging to find that our conclusions are supported by other very recent studies in which laparoscopic appendectomy was performed on different populations. These studies have concluded that laparoscopy should be used routinely for all young females presenting with right iliac fossa pain[35], that laparoscopic appendectomy is not associated with an increase in morbidity in elderly patients[36], and that laparoscopic appendectomy is safe for advanced appendicitis in children[37]. Furthermore, patients' preference (during counseling/consent) and satisfaction after the surgery (follow-up) in the laparoscopic group is evidence that the laparoscopic approach may be adopted safely in cases of appendicitis.

Conclusion

This series has demonstrated that laparoscopic appendectomy is a safe and clinically beneficial operative procedure. It provides certain advantages over open appendectomy, including short hospital stay, decreased need for postoperative analgesia, early food tolerance, and earlier return to normal activities. Where feasible, laparoscopy should be undertaken as the initial procedure of choice for most cases of appendicitis.

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