Laparoscopic versus open appendicectomy for the treatment of acute appendicitis in young patients

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Abstract

Background: Debate exists about the benefits of laparoscopic appendicectomy in acute appendicitis. In this study, we compare the safety and efficacy of laparoscopic appendicectomy with open appendicectomy in young patients with acute appendicitis.

Methods: This study is a prospective randomized clinical trial conducted in Ain Shams University Hospitals during the period from January 2007 till January 2010. One hundred forty young patients who were diagnosed as having acute appendicitis were randomized into 2 groups: group I included 70 patients who underwent laparoscopic appendicectomy (LA) and group II included 70 patients who underwent open appendicectomy (OA).

Results: The mean operative time was significantly longer in the LA group (60±25 mins) than the OA group (45±15 mins) (P<0.01). There was a need for conversion to OA in 3 patients of the LA group (4.29%) due to extensive adhesions. There was no significant difference in the incidence of intraoperative complications between both groups. There was a statistically significant lower incidence of wound infection and wound seroma in the LA group (2.86% and 1.43% respectively) than the OA group (14.29% and 10% respectively) (P<0.05). There was a statistically insignificant higher incidence of intraabdominal collection in the LA group (4 patients, 5.71%) than OA group (2 patients, 2,86%) (P>0.1). The hospital stay was significantly shorter in the LA group (1.5±0.5 days) than the OA group (2±1 days) (P<0.001). The average cost was significantly higher in the LA group (3300±400 LE) than the OA group (1500+200 LE) (P<0.001).

Conclusion: LA is safe and effective for the treatment of acute appendicitis as there is no significant incidence of major intraabdominal complications, there is lower incidence of postoperative complications especially wound infection than OA, and there is significantly shorter hospital stay. However, the mean operative time is significantly longer in the LA group, and the cost of LA is significantly higher than OA. Also the incidence of postoperative intraabdominal collection is higher in LA than OA, yet non significant.

Key words: Laparoscopic, appendicectomy, acute appendicitis.

Introduction:

Appendectomy remains the most frequently performed emergency abdominal surgical procedure.[1] The lifetime risk of acute appendicitis for men and women is 8.6% and 6.7% respectively. However, the lifetime risk of having an appendectomy is 12% for men and 25% for women.[2-4]

Laparoscopic appendicectomy was first described by Semm in 1983.[5]

Combining clinical history, physical examination and laboratory studies has led to the development of scoring systems and computer-aided algorithms to help clinicians with decision making in acute appendicitis.[6] Overall, the actual gain of scoring systems

appears small and the performance of these scores outside study conditions is often disappointing.[7]

Laparoscopic inspection of the abdominal cavity enables the surgeon to diagnose acute appendicitis accurately. Criteria for the diagnosis of appendicitis during laparoscopic inspection are the presence of unequivocal inflammatory changes, such as pus, fibrin, or vascular injection of the serosa. Rigidity and lack of mobility at manipulation are less certain signs of inflammation.[7]

Even after the extended use of ultrasonography in all patients suspected of having acute appendicitis, around 20% of female patients and 8-10% of male patients will have a negative appendix during laparoscopic intervention. Therefore, in all patients planned to undergo a laparoscopic appendicectomy, the initial diagnostic character of this intervention should be stressed. If the appendix is normal, the whole abdominal cavity should be examined starting with the internal genitals.[7]

The fate of a normal appendix has also been defined, it is safe to remove it just as in open surgery, but it is also safe to leave.[8] In one study, there was only a 1% incidence of subsequent appendicitis after 4 years of follow-up.[9]

Removing a normal appendix at open surgery is associated with a 7-13% risk of early complications and 4% of late complications such as incisional hernia and chronic pain in the first year after operation. If a normal appendix is left in situ during diagnostic laparoscopy, the number of unnecessary appendectomies will decrease, particularly in fertile women (17-45%).[7]

Laparoscopy in suspected appendicitis is found to be a particularly useful procedure in women of childbearing age, where there is a high incidence of other pelvic pathology and visualization of the pelvis is far superior.[8]

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 acute appendicitis very attractive.[10]

However, several retrospective studies, several randomized trials and meta-analyses comparing laparoscopic with open appendectomy have provided conflicting results.[10]

Although there is no consensus regarding the superiority of the laparoscopic approach over the conventional technique, there is trend towards greater utilization of laparoscopic appendectomy.[11,12]

The present study is a prospective randomized controlled clinical trial comparing laparoscopic versus open appendicectomy regarding operative time, operative and postoperative complications, hospital stay, and cost of the procedure.

Patients and methods:

During the period from January 2007 till January 2010, one hundred forty young patients who attended the Surgical Casualty Clinics in Ain Shams University Hospitals and were diagnosed as having acute appendicitis were randomly categorized into 2 groups: Group I: included 70 patients who were planned to be operated upon by laparoscopic appendicectomy & Group II: included 70 patients who were planned to be operated upon by open appendicectomy. The study is a prospective randomized clinical trial.

Exclusion criteria included patients with previous midline abdominal incisions, pregnant female patients, and patients with ascites.

Preoperative work-up included CBC, coagulation profile, S.creatinine, F.Bl. Sugar, ALT, and abdominal U/S.

Before the operation, all patients signed a preoperative consent including their agreement to participate in the study and to attend the postoperative visits and included their right to withdraw from the study at any time.

Group I patients underwent laparoscopic appendicectomy, where a zero degree camera was introduced through a 10-mm laparoscope in an infraumbilical incision in order to inspect the abdominal cavity. Another 5-mm cannula was introduced cranial to the pubic bone in the midline. A third cannula was introduced just medial to the left anterior superior spine. The appendix was retracted by means of a grasper, the meso-appendix was skeletonized

using monopolar diathermy to expose the appendicular artery which was ligated using intracorporeal suture. The appendix was completely dissected till the base. The base of the appendix was ligated by 3 intracorporeal ties, 2 left in the base and one in the removed side. Transection of the appendix between the loops was done by means of a scissor. The appendix was removed through the suprapubic cannula. Suction was performed routinely to remove any blood or purulent material. If there was any purulent collection, the peritoneal cavity was irrigated by means of lavage and a suction drain was left behind.

Open appendicectomy was performed through Grid-iron incision at the McBurney's point in the Rt iliac fossa. The mesoappendix was ligated by absorbable suture, the base of the appendix was double ligated by absorbable suture. Peritoneal toilet was performed following removal of the appendix. Peritoneal irrigation by warm saline followed by suction and insertion of a portovac was performed in the presence of pus collection or perforated appendix.

Postoperatively, patients were given 3rd generation cephalosporin antibiotics every 12 hours and parenteral nonsteroidal anti-inflammatory drugs every 8 hours. They were kept on nothing per mouth and I.V. fluids until intestinal sounds were audible then oral fluids followed by soft diet were given. Patients were discharged when they were open bowel and afebrile.

The wound was dressed every day after discharge of the patients in the outpatient clinic. Stitches were removed after 7-10 days. Patients were followed up afterwards every week for 2 months.

Both groups of patients were compared regarding patient characteristics (age & sex), mean operative time, operative and postoperative complications, hospital stay, and cost of the procedure.

Statistical analysis was performed using Chi-squared test, and unpaired t-test. P-value <0.05 was considered significant.

Results:

During the period from January 2007 till January 2010, 140 consecutive young patients who were diagnosed as having acute appendicitis were randomized into 2 groups:

Group I: included 70 patients who were operated upon by laparoscopic appendicectomy.

Group II: included 70 patients who were operated upon by open appendicectomy.

There was no statistically significant difference between both groups regarding their age and sex. The mean age for group I & II was 25.5 ± 2.5 years and 26 ± 1.5 years respectively (P>0.1), **Table(1)**.

Group I included 46 females & 24 males while group II included 40 females and 30 males, **Table(1)**.

Table (1): Age and gender of the 2 groups.

	Group I	Group II	P-value
Mean age (years ± SD)	25.5 ± 2.5	26 ± 1.5	>0.1
Gender			
Male	46 (65.71%)	40 (57.14%)	>0.1
Female	24 (54.29%)	30 (42.86%)	

The mean operative time was significantly longer in the laparoscopic appendicectomy group (60 ± 25 minutes) compared to the open appendicectomy group (45 ± 15 minutes) (P<0.01) **Table(2)**.

Table (2): Mean operative time.

	Group I	Group II	P-value
Mean operative time (min ± SD)	60 ± 25	45 ± 15	<0.01

There was a need for conversion to the open approach in 3 patients of the laparoscopic group (4.29%) due to extensive adhesions rendering appendiceal mobilization difficult.

There was no mortality in either the laparoscopic or open group.

Regarding the complications **Table(3)**, there was no statistically significant difference in the incidence of intraoperative complications as one patient of the LA group suffered from intraoperative injury of the small intestine by electrocautery (1.428%) which was repaired in 2 layers by 2-0 absorbable sutures, while no patients in the other group suffered from the same complication (0%) (P=NS). In the OA group, injury to the inferior epigastric artery occurred during insertion of the redivac in 1 patient which required underrunning of the ends of the artery (1.428%) while no patient in the LA group suffered from the same complication (0%) (P=NS).

There was a statistically significant lower incidence of wound infection in the LA group (2 patients = 2.86%) than in the OA group (10 patients = 14.29%) (P<0.05). There was also lower incidence of wound seroma in the LA group (1 patients = 1.428%) than OA group (7 patients = 10%) (P<0.05).

Postoperative intraabdominal collection occurred in 4 patients in the LA group (5.71%) and in 2 patients in the OA group (2.86%) (Odds ratio = 2.06). However the difference was statistically insignificant (P>0.1). The collection was aspirated by U/S guided pig tail insertion with broad spectrum antibiotics and resolved without the need for exploration.

The overall incidence of complications was higher in the OA group than LA group (20 patients = 28.57% versus 8 patients = 11.43% respectively) (P <0.05).

Table (3): Operative & postoperative complications.

Group / Complication	LA	OA	P-value
Intestinal injury	1	0	NS*
Inf. epigastric artery injury	0	1	NS*
Wound infection	2	10	P<0.05
Wound seroma	1	7	P <0.05
Intraabdominal collection	4	2	P>0.1
Overall complications	8	20	P<0.05

** NS = Non significant*

There was a statistically significant shorter hospital stay in the laparoscopic appendicectomy group (1.5±0.5 days) than the open appendicectomy group (2±1 days) (P<0.001) **Table(4)**.

For the patients who where operated upon in Ain Shams University Specialized Hospital (36 patients in LA and 50 patients in OA group): The average cost for the patients in the LA group was 3300±400 LE, which was significantly higher than the average cost in the OA group (1500±200 LE) (P<0.001) **Table(4)**

Table (4): Hospital stay and cost.

	LA group	OA group	P-value
Hospital stay (days ± SD)	1.5 ± 0.5	2 ± 1	<0.001
Cost (LE ± SD)	3300 ± 400	1500 ± 200	<0.001

Discussion:

Although more than 20 years had elapsed since the introduction of laparoscopic appendectomy, there is no consensus on its advantages and disadvantages compared to the conventional technique.[10]

In our study, the mean operative time was significantly longer in the laparoscopic appendicectomy group (60±25 minutes) compared to the open appendicectomy group (45±15 minutes) (P<0.01). In a prospective randomized clinical study, the operative time was significantly longer in the LA group (80 min. "60-105") than the OA group (60 minutes "45-75") (P=0.000). The study attributed that to the inclusion of additional steps for setup, insufflation, trocar entery under direct vision, and diagnostic laparoscopy[13]. By contrast, in another study, the operation times were nearly similar in the two techniques (47±19.6 min in the open group vs 44.3±24 min. in the laparoscopic group; P=0.31).[10] In a retrospective study of patients undergoing laparoscopic appendicectomy over a 54-month period, the median operative time was 30 min. (range, 14-75 min.). This operative time is quicker than that reported in most of the prospective studies comparing laparoscopic approaches with open procedures.[14]

In the laparoscopic group in our study there was a need for conversion to the open approach in 3 patients (4.29%). In a study, conversion to an open procedure was required in two patients (1.5%) due to extensive caecal adhesion secondary to severe inflammation.[10]

In our study, there was no mortality in either group (0%). This is consistent with the majority of past publications. The overall reported mortality of appendectomy is very low and was estimated in a review of a large administrative database at 0.05% for LA and 0.3% for OA.[15]

Regarding the incidence of overall complications, it was significantly higher in the OA group (20 patients = 28.57%) than the LA group (8 patients = 11.43%) (P <0.05). This result was consistent with the results of a study based on a large administrative data base, where the overall complications were significantly lower in the LA group (8.7%) than the OA group (11.1%) (P<0.0001).[15] However in 2 other studies the difference was insignificant; as in the first study the overall complication rates were 10.6% and 8.1% for open and laparoscopic appendectomy respectively (P=0.43),[10] and in the other study, the overall complication rates were 18.5% in the LA group versus 17.1% in the OA group (P=1.00).[13]

Regarding the intraoperative complications in our study, there was no statistically significant difference in both groups; as one patient in the LA group suffered from intraoperative injury of the small intestine (1.428%), while one patient in the open appendicectomy group suffered from injury to the inferior epigastric artery during redivac insertion (1.428%) (P=NS). This result was consistent with other studies. In a study based on a large database, complications during the procedure occurred in 126 patients (0.4%) in OA group and 21 patients (0.3%) in LA group (P=0.7)15. In another study, one patient in the LA group suffered from intestinal injury that occurred during insertion of the visiport, the lesion was recognized intra-operatively and was successfully managed with endoscopic sutures.[10]

In our study, there was a statistically significant lower incidence of wound infection in the LA group (2 patients = 2.86%) than in the OA group (10 patients = 14.29%) (P <0.05). There was also a statistically significant lower incidence of wound seroma in the LA group (1 patient = 1.43%) than in the OA group (7 patients = 10%) (P <0.05). These results are consistent with other studies. In a study, open appendectomy was associated with a significantly higher incidence of wound infection compared with the laparoscopic group (12.8% vs 5.3%, P = 0.03).[10] In another study, the rate of infections was significantly lower in patients undergoing LA (LA: 0.8%, OA: 1.9%, P<0.0001).[15] However, in a 3rd study, there was no significant difference in the incidence of wound infection in both groups (LA = 6.2%, OA = 6.7%; P=1.00).[13]

In our study, the incidence of postoperative intraabdominal collection was higher in the LA group (4 patients, 5.71%) than the OA group (2 patients, 2.86%) (OR = 2.06). However the difference was statistically

insignificant (P>0.1). The collection was aspirated with U/S guided pig tail insertion with broad spectrum antibiotics and resolved without the need for exploration. This result was consistent with other studies. In a study, there was no significant difference in the incidence of intraabdominal abscess rates between LA and OA (5.3% versus 3% respectively; P=0.51).[13] However in another study, the incidence of intraabdominal abscess formation was significantly higher in patients with complicated appendicectomy with severe peritonitis who were treated laparoscopically (5.3% vs 2.1 for OA; P=0.002).[10] In the Cochrane Central Register of Controlled Trials, the incidence of intraabdominal abscesses was increased after LA than after OA (OR = 2.48, 95% CI=1.45 - 4.21).[16]

In our study, there was a statistically significant shorter hospital stay in the LA group (1.5 ± 0.5 days) than the OA group (2 ± 1 days) (P<0.001). This result was consistent with other studies. In a study, the mean postoperative hospital stay was 2.2 d (range 1-17 d) after LA and 3.1 d (range 1-18 d) after OA (P=0.04).[10] In another study, the unadjusted length of stay was significantly shorter after LA (2.6 days) than after OA (3.8 days) (P<0.0001).[15] In a 3rd study, hospital stay was shortened by 1.1 days (95% CI = 0.6 to 1.5) after LA.[16] However, in a study the length of hospitalization was the same for both groups (P = 0.66).[13]

In our study, for patients who were operated upon in Ain Shams University Specialized Hospital: The average cost for patients in the LA group was 3300 ± 400 LE, which was significantly higher than the average cost in the OA group (1500 ± 200 LE) (P<0.001). In a study, the operative costs were higher by 370 Euros in the laparoscopic group.[10] In the Cochrane Central Register of Controlled Trials, while the operation costs of LA were significantly higher, the costs outside hospital were reduced.[16]

In conclusion, our study results demonstrated that laparoscopic appendicectomy is safe as there is no significant incidence of major intraoperative complications than OA. LA is also associated with significantly lower incidence of postoperative complications especially wound infection than OA. LA also significantly reduces the hospital stay than OA. However, the mean operative time is significantly higher in LA group, there is a need for conversion to OA in 4.29% of the patients in the presence of extensive adhesions, and the cost of LA is significantly higher than OA. The incidence of postoperative intraabdominal collection is higher in LA group than in OA, however it was statistically insignificant.

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