

# Laparoscopic versus open appendectomy in patients with acute appendicitis

\* Tariq Al-Aubaidi FICMS

## Abstract

**Background:** Laparoscopic surgery for appendicitis is now a well established and advanced method of performing general surgical procedures.

**Objectives:** To compare the outcome of laparoscopic and open appendectomies in terms of operative time, analgesic requirement, postoperative complications, hospital stay, return to normal activity and condition of scar.

**Methods:** This prospective study was carried out from 1<sup>st</sup> May 2008-1<sup>st</sup> January 2010, involving 110 patients (45 male and 65 female) with features suggestive of acute appendicitis were divided into 45 patients laparoscopic appendectomy (LA) group and 65 patients open appendectomy (OA) group, after taking informed consent. LA was done with the help of three trocars/cannulae creating pneumoperitoneum with CO<sub>2</sub> whereas OA was performed by grid iron incision.

**Results:** Forty five patients were assigned to the laparoscopic appendectomy group and 65 patients were assigned to the open appendectomy group. Five patients were converted intra-operatively from laparoscopic appendectomies to open procedures. The operating times in OA and LA were 20-110 minutes (mean 30) and 45-120 minutes (mean 55) respectively. Increased doses of analgesics, antibiotics and antiemetics were required in OA, as compared to LA. The mean postoperative hospital stay in LA group was 1 day (range 1-3 days) where as it was; 2.2 days (range 2-5 days) in OA group.

**Conclusion:** LA is safe and it has major benefits like less postoperative pain, decreased wound infection, early hospital discharge, early return to work and a better cosmetic scar than OA.

**Keywords:** laparoscopic, open, appendectomy, acute appendicitis.

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## Introduction

Appendicitis is the most common intra abdominal condition requiring emergency surgery. For more than a century open appendectomy remained the gold standard of treatment of a acute appendicitis and for interval appendectomy. With the advent of new surgical techniques the quest has been raised for minimally invasive techniques for treatment of various surgical ailments <sup>(1)</sup>. Open appendectomy is used since last century. In 1983, a German gynecologist Semma performed the first laparoscopic appendectomy. Laparoscopic surgery is now a well established and advanced method of performing general surgical procedures. In some teaching hospitals all patients with pain right iliac fossa have to undergo laparoscopy before proceeding to appendectomy <sup>(2)</sup>. Laparoscopic appendectomy gives a better evaluation of the peritoneal cavity than that obtained by the standard grid-iron exposure. The procedure allows rapid and thorough inspection of the para-colic gutters and the pelvic cavity that is not possible with the

open grid-iron approach. The laparoscopic approach for patient with suspected appendicitis improves the diagnostic accuracy and is therefore recommended <sup>(3)</sup>. Laparoscopic appendectomy has emerged as a safe procedure results may vary depending upon the type of procedure and patient's overall condition. Common advantages of laparoscopic appendectomy are: less postoperative pain may shorten hospital stay, may result in a quicker return to bowel function, quicker return to normal activity and better cosmetic results <sup>(4)</sup>.

## Methods:

This prospective study was carried out from 1<sup>st</sup> May 2008- 1<sup>st</sup> January 2010, involving 110 patients (45 male and 65 female) conducted at first surgical unit in Baghdad Teaching Hospital in Medical City, ranging age 16-59 years with features suggestive of acute appendicitis were included in this study by convenient sampling method. Patients were divided in to laparoscopic appendectomy group LA and open

appendectomy group OA, after taking informed consent.

Inclusion criteria; these patients presented with history of right lower quadrant pain or periumbilical pain, less than 24 hours duration migrating to the right lower quadrant associated with nausea and or vomiting and history of anorexia with or without fever. On physical examination right iliac fossa tenderness and or rebound tenderness with some times positive cough and Rovsing's sign also elevated temperature may be found. On laboratory investigation leukocytosis above 10000cells per ml, and urine analysis and chest x-ray done for all patients. Abdominal ultrasound mostly done specially for females to exclude diseases that mimic acute appendicitis.

Exclusion criteria; patients were excluded if the diagnosis of appendicitis was not clinically established and if they had a history of symptoms for more than 5 days and or a palpable mass in the right lower quadrant suggesting an appendicular mass or abscess. Patients with following conditions also excluded; history of generalized peritonitis, coagulation disorder, pregnancy, and inability to give informed consent due to mental disability. All patients received 1g cefotaxime every 8 hours intravenously from the time of diagnosis until surgery.

Technique of laparoscopic appendectomy: the patient is in supine position, arms tucked at the side. The surgeon stands on the left of the patient with scrub nurse and camera holder assistant. A pneumoperitonum is obtained in the usual fashion. Three trocars are inserted two trocars, the first 10mm above the umbilicus and right upper quadrant respectively and the other 5mm in the left iliac fossa. The cecum is retracted upward toward the liver; this maneuver elevates the appendix in the optical field of the telescope. The appendix is grasped at its tip with 5mm grasper via the left iliac fossa. It is held in upward position. After identification of the appendix, mesoappendicular vessels were divided between endovascular clips. Three endovascular clips or chromic endoloops placed around the appendix which was divided between two proximal and one distal endoloops. The appendix is pulled in to right upper trocars. Both the appendix and trocar

are removed in such a fashion that the appendix should not touch the abdominal wall. Trocar is replaced, abdomen washed with saline and drain is placed in right lower quadrant if need. The appendix sends to histopathological study.

Postoperative course: strict criteria were followed for the reintroduction of nutrition. Bowel sounds were checked every 6 hours. Once present, the patients were started on a clear liquid diet and advanced to regular diet when the liquid diet was tolerated and flatus observed. Patients were discharged when they tolerated a regular diet and were febrile. Technique of open appendectomy was done by standard grid iron incision or Lanz incision.

Outcome parameters: The following parameters were recorded. Operative findings and time taken for each operation were recorded. The operative time was noted from making skin incision to skin closure. The use of postoperative analgesics and antibiotics, dates of discharge as well as complications during hospital stay were recorded. At postoperative visit, 8 days after discharge, the history of state of general health and time taken for return to normal activities was recorded. Operated area was examined for evidence of wound infection, condition of scar and the results of histopathological studies.

Statistical methods: continuous data variables were compared between groups using student's t-test of the mean. Discontinuous variables and proportions were compared using Chi-square test. A p-value of less than 0.05 was considered to be statistically significant.

### **Results:**

Five patients (11.1%) were converted from laparoscopic to open appendectomies during surgery mostly in early cases of study, and their results remain in the laparoscopic group. The reasons for conversion were as follow; 1<sup>st</sup> case converted due to bleeding from mesoappendix occurred during dissection and trying to clipping the of appendicular artery, 2<sup>nd</sup> case converted due to technical cause, 3<sup>rd</sup> and 4<sup>th</sup> cases are converted due to adhesions of the appendix to the ceacal wall and difficult anatomy to

identified the appendix, and the last one converted due to suspicion of bowel injury. Average age was similar in both groups (16-59 years), and the mean age was 28 years in OA group and 22 years in LA group, and male: female ratio was different in both groups, in OA group was (30-35) and in LA group was (15-35). There were no significant differences in age, body build, clinical presentation or laboratory findings between the groups. Regarding the duration of surgery, mean time of duration of surgery was 30 minutes for OA group and 55 minutes for LA group ( $p < 0.001$ ). The mean

postoperative hospital stay in LA group was 1 day, where as in OA group, it was 2.2 days, statistically not significant differences were noted in the length of hospitalization and interval until the resumption of a regular diet. Patients who underwent LA had a shorter duration of parenteral and oral analgesic use than OA which were (2) days versus (1.2) days and (8) days versus (5.4) days respectively ( $p < 0.02$ , statistically significant). Patients who had LA returned to full activities in (12) days postoperatively versus (21) days for patients who underwent OA ( $p < 0.001$ ). Table (1).

**Table (1) comparison of open and laparoscopic appendectomy**

	Open	Laparoscopic	P value
Average age (years)	28 (16-59)	22 (16-59)	NS
Male: female ratio	30:35	15:30	NS
Acute appendicitis percent	81%	84%	NS
Mean operating time (min)	30 (20-110)	55 (45-120)	0.001
Postoperative Regular diet (days)	2.5(2-6)	1.2(0.6-3)	NS
Hospitalization (days)	2.2(2-5)	1(1-3)	NS
Parental analgesic use (days)	2.0(1.8-5.40)	1.2(0.8-2.3)	0.02
Oral analgesic use (days)	8.0(6-14)	5.4(5-8)	0.02
Return to full activities (days)	21(15-28)	12(8-14)	0.001

The condition of scar was better in LA group. Most of the postoperative complications were observed after OA as compared to LA but none were statistically significant apart from pain was significant ( $p$  value 0.01), as all the OA group complain from pain postoperatively (100%), vomiting (45%), fever (14%), wound infection (13%), paralytic ileus (17%), respiratory tract

infection (6%) and deep venous thrombosis (DVT) was (3%). While in LA group complications were as following; pain (48%), vomiting (20%), fever (10%), wound infection (2%), paralytic ileus (4%), respiratory tract infection (4%) and no cases recorded in LA complaint postoperatively from DVT. Table (2).

**Table (2) postoperative complications in LA and OA groups**

No	COMPLICATION	LAPAROSCOPIC APPENDICECTOMY		OPEN APPENDICECTOMY		P value
		NO. of cases	%	NO. of cases	%	
1	Pain	22	48	65	100	0.01
2	Vomiting	7	20	26	45	N.S
3	Fever	6	10	10	14	N.S
4	Wound infection	1	2	8	13	N.S
5	Paralytic ileus	2	4	12	17	N.S
6	DVT	0	0	2	3	N.S
7	Respiratory Tract infection	2	4	4	6	N.S

Postoperatively parenteral doses of analgesic, antibiotic and antiemetic drugs were different in both group, in LA group mean parenteral doses of analgesic drugs was (1.4), antibiotic

drugs (4.6) and antiemetic drugs (0.5) were compared to doses used in OA group as analgesic (3.8), antibiotic (8.9) and antiemetic (1.6).Table (3).

**Table (3) total number of parenteral doses of drugs used in postoperative period**

NO	DRUGS	LAPAROSCOPIC APPENDICECTOMY		OPEN APPENDICECTOMY	
		Range	Mean	Range	Mean
1	Analgesics	1– 3 doses	1.4 doses	3–6 doses	3.8 doses
2	Antibiotics	3 – 6doses	4.6 doses	6–10doses	8.9 doses
3	Antiemetics	0 – 2doses	0.5 doses	0– 4 doses	1.6 doses

Fifty six patients (81%) in the OA group and 40 patients (89%) in LA group had acute appendicitis. grossly 9 patients (19%) in OA group and 5 patients (11%) in LA group had normal appendix. Forty patients (61.5%) in OA group 20 patients (44.4%) in LA group

had inflamed appendix. Ten patients (10.3%) in OA group and 13 patients (29%) in LA group had severely inflamed. Six patients (9.2%) in OA group and 7 patients (15.5%) in LA group had perforation eminent. Table (4).

**Table (4) Degree of inflammation grossly.**

Type of appendix	OA group		LA Group	
	No	%	No	%
Normal	9	19%	5	11.1%
Inflamed	40	61.5%	20	44.4%
Severely Inflamed	10	10.3%	13	29%
Perforation eminent	6	9.2%	7	15.5%
Total	65	100%	45	100%

**Discussion:**

Laparoscopic appendectomy had gained a lot of attention around the world. However, the role of laparoscopy for appendectomy, one of the commonest indications remains controversial. Several controlled trials have been conducted, some are in favors of laparoscopy, and others are not<sup>(5)</sup>. The goal of this review was to ascertain that if the laparoscopic appendectomy is superior to conventional and if so what are the benefits and how it could be instituted more widely. There is also diversity in the quality of the randomized controlled trials<sup>(6)</sup>. It has been found among the surgeons that there is a hidden competition between laparoscopic surgeons and the surgeons who are still doing conventional surgery, and this competition influences the result of study. One should always think of laparoscopic surgery and open as being complimentary to each other. The result of many comparative studies have shown that outcome of laparoscopic appendectomy was influenced by the experience and technique of the operator<sup>(7)</sup>. Laparoscopic appendectomy gives a better evaluation of the peritoneal cavity than that obtained by the standard grid iron exposure. The procedure allows rapid and thorough inspection of the paracolic gutters and pelvic cavity that is not possible with the open grid iron approach. The laparoscopic approach for patients with suspected appendicitis improves the diagnostic accuracy and is therefore recommended<sup>(3)</sup>. Most surgeons agree on the use of laparoscopy when a patient is a young female with vague lower abdominal pain and its progress to appendectomy. There are innumerable reports showing that laparoscopy improves diagnosis and reduces unnecessary appendectomies in fertile women<sup>(8,9)</sup>. In this study the mean operative time was about 25 minutes shorter in OA group as compared to LA group. In almost all literatures the operating time of laparoscopic appendectomy was found to be more than that of open appendectomy the difference in mean operating time ranged from 8.3 to 29 minutes. The operating time of laparoscopic appendectomy also depend on the experience of the surgeon and the

competence of their team<sup>(1)</sup>. In considering operating time the exact identification of the timing of the start of the procedure and its conclusion vary. In general the time should be calculated from the insertion of first trocars to the end of skin suturing. Cox et al defined operating time as the time from incision to wound closure<sup>(10, 11,12)</sup>. Tate et al calculated the time as use of anesthesia to the administration of a reversal agent<sup>(13)</sup>. Generally all laparoscopic procedures are more time consuming for the following reasons; inherent nature of slow maneuver of laparoscopic techniques, time taken by careful slow insufflations and routine diagnostic laparoscopy before any laparoscopic procedure. This is comparable to other studies reporting about 10.7 to 30 minutes shorter mean operative time for OA group<sup>(14,15)</sup>. The incidence of conversion to open append-ectomy in this study was similar to that reported by Lujan Moupean (11%)<sup>(16)</sup>, but less than those reported in Pokala et al, Young et al, Pederson et al and Long et al ( 15%-28%)<sup>(11,15,17,18)</sup> and higher than those reported in Yau *et al* and Gupta *et al* ( 7%-8%)<sup>(12,19)</sup>. Mean analgesic requirement in postoperative period of LA group was 1.4 doses and is comparable to report done by Tate JJ et al was 1.2 doses<sup>(13)</sup>. Mean analgesic requirement of OA group was 3.8 doses and is substantially higher than that reported in other studies<sup>(19)</sup>. In this study postoperative complications were minor and occurred much less in patients of LA group. They were treated conservatively. The wound infection rates of LA and OA groups were 2% and 8% respectively and are more comparable to other studies reporting rates of 0% to 6% and 5% to 11% in LA and OA groups respectively<sup>(13,18,20)</sup>. In this study the mean period of hospital stay was (1.2) days shorter in LA group (1) day than OA group (2.2) days and this difference is slightly higher than that reported in Yau KK et al and Kamal M et al<sup>(14,19)</sup> and similar to result reported in Lujan et al and Tate et al<sup>(13,16)</sup>. Mean period of return to normal activity was 9 days earlier in LA group (12)days than OA group( 21) days and is comparable to the figures reported in Reierston et al and Pederson et al was 8

days earlier in LA group (11) days than OA group (19) days (3) <sup>(11)</sup>. The scar of LA group were better than those observed after OA group and this superiority of scar has also been reported in other studies <sup>(21,22)</sup>. Most surgeons have the

opinion that laparoscopic appendectomy is cost effective. It may be more expensive for the hospital but it offers diagnostic accuracy, and among employed patients, offers cost savings to society as result of faster return to work <sup>(6,23,24)</sup>.

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*\*From the Department of microphology Baghdad University  
Correspondence Address to :Dr. Sana'a Khudhur Jameel  
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