

# Laparoscopic versus Open Appendectomy: A Jordanian Perspective

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## Abstract

**Objective:** To determine whether there is an advantage to Laparoscopic Appendectomy compared with Open Appendectomy.

**Background:** Laparoscopic Appendectomy (LA) is relatively new in Jordan. Although it is widely practiced worldwide, it has not replaced the open conventional procedure, may be because there are no clear-cut benefits of Laparoscopic Appendectomy over Open Appendectomy (OA), in the literature.

**Materials and Methods:** We did a review of the records of 50 LAs for acute appendicitis done by the second author at King Abdullah University Hospital (KAUH) from June, 2003 till October, 2005 and compared them to 50 randomly selected OAs done by the same surgeon at the same period of time. The studied points included the patients' demographic data, operating time, post-operative analgesia, postoperative complications, the length of hospital stay and time taken to return to work or activities. Differences were considered statistically significant at a P-value that equals or is less than 0.05.

**Results:** Patients' demographics and operative findings were similar in both groups. There was no conversion to open appendectomy. Mean duration of surgery was 35.4 minutes for Laparoscopic Appendectomy and 33.1 minutes for Open Appendectomy ( $p < 0.1$ ). The rate of wound infection and other complications for LA was 0%, while for the OA group, 4 (8%) patients had wound infection ( $P < 0.058$ ). The LA group had reduced post-operative analgesia requirements ( $P < 0.0001$ ). The LA group had a shorter hospital stay ( $P < 0.0001$ ), and a significantly shorter time taken to be able to return to work ( $P < 0.0001$ ).

**Conclusion:** Laparoscopic Appendectomy has significant advantages over Open Appendectomy with respect to length of hospital stay, the shorter convalescence and sooner return to daily activities, with less complication rate and equal or less operative time. We highly recommend the use of laparoscopic technique as the treatment of choice for acute appendicitis.

**Keywords:** Appendix, Laparoscope.

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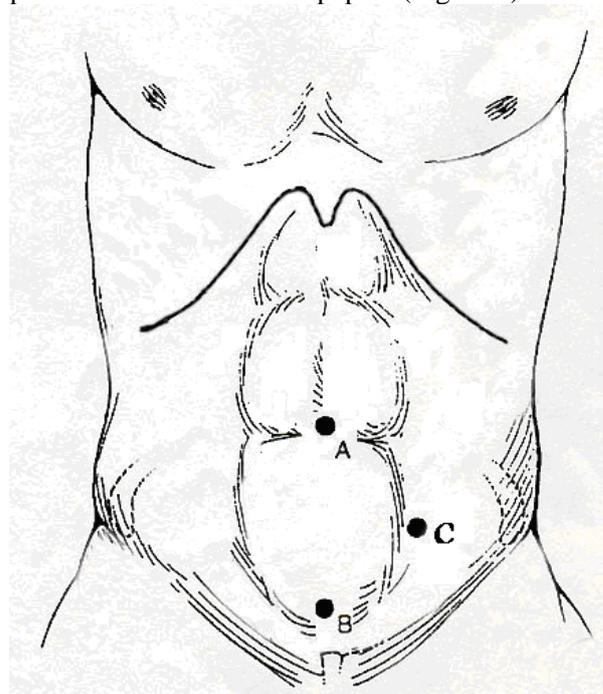
## Introduction

Open Appendectomy is the traditional procedure of choice for acute appendicitis, and has remained essentially unchanged since its description by Charles McBurney in 1889.<sup>1</sup> It is not until 1983, when Kurt Semm described the technique of LA.<sup>2</sup> However, it never became the operation of choice for appendectomy, as laparoscopy replaced the open conventional technique for cholecystectomy. The traditional Open Appendectomy is performed through a small muscle-splitting incision, which can be considered as good as any minimally invasive procedure. However, a few advantages are now well-documented in the literature, including the diagnostic value of laparoscopy, and the improved post-operative recovery, not to forget the decreased rate of adhesions formation following laparoscopic procedures in addition to fewer rates of wound complications. But, because the validity of these points remains unconvincing, and because of shortage of laparoscopic sets in some hospitals, especially during the night, LA is not practiced widely. It is the aim of this study to highlight the benefits of LA and to encourage the acceptance of LA as the procedure of choice for acute appendicitis.

## Surgical Technique

Patients should be evaluated and prepared for laparoscopic surgery in exactly the same manner followed in the case of open surgery; patients are positioned supine with only the left arm tucked to the patient's side, allowing room for both the surgeon and camera operator. A three-trocar technique is used; a 10-mm port for the camera is placed in the vicinity of the umbilicus using open technique (Hasson technique). Creation of the working space is achieved by gradual insufflation of CO<sub>2</sub> gas to a maximum pressure of 15 mmHg. The other two 5-mm operating ports are placed under direct vision, one in the suprapubic region and the other in the left iliac quadrant. However, both port sites can be slightly modified depending on the contour of the abdomen, to allow a two-handed dissection technique.

In our experience, there was no need for a fourth port as described in some papers. (Figure.1)



**Figure (1): Ports locations. A: periumbilical, 10 mm (camera); B: suprapubic, 5mm; C: left lower quadrant, 5mm.**

We use atraumatic grasping forceps or atraumatic Babcock forceps to expose the appendix by grasping the tip to retract it in different directions depending on the anatomical location of the appendix for maximal visualization. Dissection of the mesoappendix is performed as close as possible to the edge of the appendix, by stripping it off the appendix using electrocautery, starting at the tip of the appendix and tracing it to its base on the cecum. In this region, the appendicular artery is an end artery, which can be controlled easily with electrocautery, without the need for any further time consuming maneuvers to control it. The base of the appendix should be cleared of any adipose and inflamed connective tissue, and it is secured with laparoscopic sutures, including intracorporeal and extracorporeal knot tying and the use of pretied loop ligature. Our practice is to secure the stump with two ligatures, without invagination of the remaining stump.

We introduce a 5mm-telescope in one of the 5-mm operating ports, to extract the appendix under direct vision through the 10-mm port. A relatively small appendix may be pulled into the sheath, and the entire sheath can be removed from the abdominal wall. However, we usually use a retrieval bag for extracting the appendix to avoid the inflamed appendix from touching the abdominal wall.

### Materials and Methods

We reviewed the records of 50 LAs for acute appendicitis done by the second author at KAUH, during the period from June 2003 until October 2005, and compared them to 50 randomly selected OAs done at the same period of time. All the patients in both groups were fully evaluated and diagnosed to have acute appendicitis.

OA was performed in all cases through a McBurney's muscle splitting incision, with invagination of the base of the appendix.

For LA group, the operation was conducted using the three-trocar technique. There was no conversion to open appendectomies in all the fifty cases.

Postoperatively, a note was made on the macroscopical nature of the appendix. The resected appendix was routinely sent for histopathological examination. There was no tube drainage, in both groups. Antibiotic prophylaxis included a single dose of second generation cephalosporin for uncomplicated cases. For complicated cases, metronidazol was added to the regimen. Analgesics, in the form of pethidine (meperidine) alternating with NSAIDs, was given in the first 12 hours post-op, and then changed to only diclofenac sodium as needed by the patient. Oral fluid intake was resumed in most of the patients in the first post-operative day, apart from few patients in the OA group who prolonged post-operative ileus and resumed their diet on the third post-operative day. Patients were sent home when fully mobilized. Patients were followed regularly in the clinic; one-week after discharge.

### Statistical Methods

Statistical analysis was performed using Wilcoxon rank sum tests. A  $p$ -value  $< 0.05$  was considered significant.

### Results

The outcome of 50 cases of Laparoscopic Appendectomy compared to 50 cases of Open Appendectomy, done by the second author at KUH, Irbid, Jordan, were analyzed. In the LA group, there were 18 males and 32 females. In the OA group, there were 22 males and 28 females. Other demographic data (age, body mass index) were comparable in both groups. One patient from the OA group had a history of previous abdominal surgery. For the Laparoscopic Appendectomy group, patients' average age was 28.18 years (17-55 years). Inflamed appendix was noted in 44 (88%) patients, confirmed by histopathology (one patient had carcinoid tumor that required no further intervention). 2(4%) out of the 44 patients with inflamed appendix had perforated appendicitis. In 6(12%) patients the appendix was normal. There was no conversion to OA. Whereas, in the Open Appendectomy group; patients' average age was 28.9 years (15-61 years). Acute appendicitis were confirmed in 45(90%) patients. The appendix was normal in 5(10%) patients. The average operative time in LA group was 35.4 minutes (20-45 min) while for the OA group it was 33.1 minutes (25-40 min), ( $p < 0.1$ ). All of the 50 patients in the LA group had a smooth postoperative course, with no complications (0%). However for the OA group we had 4(8%) patients with minor wound infection, ( $p < 0.058$ ), which is close to be statistically significant. Average number of analgesia requested by the LA group for their whole period of hospital stay was 2.22 times, (1-4 times). While the average number of analgesia given to the OA group was 5.7 times (4-8 times) with a statistically significant difference ( $P < 0.0001$ ). Regarding the length of hospital stay, it ranged from 1-5 days with an average of 1.3 days for the LA group, which is a statistically significant difference in comparison to OA group, which needed a hospital stay with an average of

3.88 days (2-7 days) ( $p < 0.0001$ ). The average of days needed to return to work starting from the time of discharge was 7.68 days (7-10 days) for LA group, and 12.38 days (8-14 days) for the OA group with ( $p < 0.0001$ ).

## Discussion

Appendectomy is currently the most common general surgery procedure performed throughout the world. Despite the rapid advances in many areas of general surgery procedures regarding laparoscopic technology, laparoscopic appendectomy has not shared the wide acceptance of laparoscopic cholecystectomy.

Laparoscopic appendectomy has been performed in many centers across the world since 1980s; yet, it has never replaced the conventional open procedure. In Europe, it is estimated that only 1.2% - 20% of all appendectomies are performed laparoscopically.<sup>4</sup> This may be explained by the lack of experience in laparoscopy, and its usual presentation which is as an emergency and at night. Furthermore, the cost of LA is higher due to the technical devices used and the longer operating time. Finally, no standardized criteria concerning the technical approach for appendectomy is available.<sup>4</sup> In addition, some surgeons almost always restrict the use of LA to female patients in childbearing age with unclear right iliac fossa pain. Thus the choice of one technique over the other is influenced by the availability of laparoscopy equipments and the surgeon's personal experience in each procedure rather than scientifically-based selection criteria. However, the results of the present study are consistent with several previous studies where LA has been shown to be a quick, safe and more convenient procedure to patients in comparison with the open technique.<sup>1-14</sup> It is well known that laparoscopy improves diagnostic accuracy, in addition to some other advantages in terms of fewer wound complications,<sup>3</sup> less pain, faster recovery and earlier return to work. On the other hand, it is argued that the benefits of LA are marginal compared to the open technique

performed by an experienced surgeon through a cosmetically acceptable incision with the minimal complications.<sup>2, 7, 11, 12</sup>

Regarding the length of hospital stay, it has been a matter of debate in the literature with contradictory results in different papers over the last decade.<sup>6, 10, 12-16</sup> Most studies report a median stay of 2-5 days irrespective of the technique. Some recent retrospective cohort studies show a shorter stay with LA,<sup>8, 9</sup> on the other hand, other retrospective investigators reported no significant difference.<sup>17</sup> Sauerland and associates reviewed the results of 28 randomized controlled trials and almost 3000 patients; they reported a significant decrease in the length of hospital stay in patients who had LA.<sup>18</sup> In our series, there was a statistically significant difference in the length of hospital stay in favor of our laparoscopic group, with a median stay of 1.44 days.

Regarding wound infection, there is a decrease incidence of wound infection using LA, especially in patients with uncomplicated appendicitis (not gangrenous or perforated appendix).<sup>6, 8, 10, 12</sup>

Ortega AE et al.<sup>6</sup> in his prospective randomized comparison between Laparoscopic Appendectomy and Open Appendectomy reported a statistically significant decrease in the incidence of wound infection in LA group.

Kum CK et al.,<sup>12</sup> in his trial comparing 52 laparoscopic and 57 open appendectomies, after excluding perforated or normal appendix, reported 5 (9 %) wound infections after open appendectomy compared with none after the laparoscopic operation.

We have 4 (8%) minor wound infections in OA group, and none in the LA group ( $p < 0.058$ ); which is close to be significant.

In the old available data, there is criticism of LA in regard to the length of the operative time.

A prospective randomized trial comparing open versus laparoscopic appendectomy was conducted by Frazee RC et al.<sup>13</sup> on 75 patients; 37 OA and 38 LA. He found a statistically significant shorter duration of surgery for OA group (65min) over the LA group (87 min). However, with the increasing experience in laparoscopic procedures, the recent studies show a comparable and sometimes even shorter duration of time. Cox MR et al.<sup>8</sup> reported comparable operative times for both OA and LA.

In regard to our surgeon who is heavily involved in laparoscopic surgery, there was no statistically significant difference regarding the operative time between both groups in our study ( $p < 0.1$ ).

In general, of the advantages of minimally invasive procedures is decreasing the abdominal wall trauma, which is reflected on the post-operative comfort of the patient, resulting in substantially reduced post-operative narcotic requirements as measured by the number and dose of pain killers given to the patients.

Long KH et al.<sup>7</sup> reported a shorter duration of parenteral analgesia in the laparoscopic group in his series, which is consistent with the advantage of laparoscopic surgery in decreasing pain experience. And this is compatible to what we found in our study, favoring the LA group, with a statistically significant difference in the amount of analgesia given to both groups ( $p < 0.0001$ ).

Our current study supports the advantages of laparoscopic surgery and earlier return to work. As we found an earlier return to work or activity with an average of 7.7 days in LA group which was a statistically significant difference between both groups. This was confirmed in almost all of the English literature we reviewed.<sup>1, 7-10, 13, 15, 16</sup>

Considering the operation costs, LA seems to surpass OA significantly. But, thinking of the total cost of the disease, taking into account the cost of accommodation, time to return to work, daily cost of inpatient unit, hourly cost of the operating room, recovery ward and the patients consumption, LA provides more clinical comfort

and economic benefits for all patients. Anyway, literature detailing cost analysis is conflicting and varies according to the standpoint of the disease, the patient, the surgeon, the treatment center, industry and society.<sup>1, 8-10, 13, 15, 16</sup>

The surplus costs of the laparoscopic procedure and recovery after surgery were evaluated in these studies; a shorter hospital stay was noticed resulting in a marginal difference in itemized total costs between the two procedures. These studies concluded that LA was slightly more expensive, but it ensures faster recovery and earlier return to work.<sup>1-16</sup>

It is worth mentioning that LA performed with a linear stapling device was superior to LA performed with loops, partly due to safer stump closure and less manipulation of the inflamed appendix. Ortega et al.,<sup>6</sup> who performed the largest prospective randomized trial comparing stapling device versus loop appendectomy, found that LA performed by stapling devices was superior to loop and even to open appendectomy. We agree with the use of staples in the cases of complicated appendicitis as it saves operative time, and provides safer closure of the stump. But the use of this device is criticized for adding to the cost of the laparoscopic procedure. However, this has not been confirmed by our data since we used only loops in our LA.

The current study confirms the technical feasibility and safety of using the electrocautery in stripping the mesoappendix at its confluence with the appendix without ligation of the appendicular artery. However, when dissecting the base of the appendix on the cecum we have to use extra caution. This resulted also in no post-operative complications, including no post-operative bleeding and intestinal perforation.

**Table (1): Open versus Laparoscope.**

Variable	OA (n=50)	LA (n=50)	P-value
Male/ Female	22/28	18/32	0.18
Mean age (years)	28.9(15-61)	28.18(17-55)	0.73
Mean Body Mass Index	26 Kg/m <sup>2</sup>	25 Kg/m <sup>2</sup>	-
Number of previous abdominal operations	1.0	0.0	-
Pathology			0.35
Normal	5 (10%)	6 (12%)	
Inflamed	45(90%)	44(88%)	
Perforated	0 (0%)	2 (4%)	
Average duration of surgery(minutes)	33.1(25-40)	35.4(20-45)	0.1
Average number of doses of analgesia given	5.7 (4-8)	2.2(1-4)	0.0001
Wound infection	4 (8.0%)	0 (0%)	0.058
Average length of hospital stay in days	3.88(2-7)	1.4(1-5)	0.0001
Average days to return to work or normal activities	12.38(8-14)	7.68(7-10)	0.0001

## Conclusion

Most of the patients with right iliac fossa pain due to acute appendicitis still undergo an open appendectomy in Jordan. The question of how acute appendicitis should be treated cannot be answered with these data. However, Laparoscopic Appendectomy is safe and effective; it has significant advantages over Open Appendectomy with respect to length of hospital stay, shorter convalescence and sooner return to daily activities, with less complication rate and equal or less operative time. We highly recommend the use of laparoscopic technique as the treatment of choice for acute appendicitis.

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## إستئصال الزائدة الدودية بالمنظار أو بالجراحة الإعتيادية: دراسة مقارنة في الأردن

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### الملخص

**الهدف:** تعد عملية استئصال الزائدة الدودية بالمنظار جديدة في الأردن. وعلى الرغم من أنها تمارس على نطاق واسع في العالم إلا أنها لم تلغ الجراحة الاعتيادية تماما، ربما لأنها تفتقر لإيجابيات تجعلها تتفوق عليها بشكل أكثر وضوحا. في هذه الدراسة، حاولنا أن نقارن بين الطريقتين والتوصل إلى إيجابيات أكثر للجراحة بالمنظار ان توفرت.

**الطريقة:** قمنا بمراجعة ملفات 50 حالة استئصال بالمنظار أجريت خلال الفترة ( حزيران 2003-تشرين الأول 2006)، وقارناها مع 50 حالة اخرى أجريت بالجراحة الاعتيادية. المقارنة شملت: بيانات المرضى، مدة العملية، كمية المسكنات التي اعطيت بعد العملية، مدة الإقامة في المستشفى، مضاعفات العملية، وفترة النقاهة.

**النتائج:** لم يتم التحول الى الجراحة الاعتيادية في أي حالة. وكان معدل المضاعفات بعد العملية بجراحة المنظار: 0%، وفي الاعتيادية: 8%. كما ان كمية المسكنات التي أعطيت بعد العملية كانت أقل بشكل ملحوظ للمرضى الذين خضعوا لجراحة المنظار. مدة العملية كانت تقريبا متساوية في كلتا الحالتين. وكان متوسط الإقامة في المستشفى وسرعة العودة الى العمل وممارسة الأنشطة اليومية أقل بكثير بالنسبة للعمليات التي أجريت بالمنظار.

**الخلاصة:** معدل المضاعفات في الجراحة بالمنظار ومعدل البقاء في المستشفى أقل بكثير، كما أنها تحتاج فترة نقاهة أقصر. ونصح بإجراء عملية استئصال الزائدة بالمنظار.

**الكلمات الدالة:** الزائدة الدودية، المنظار.