



## ORIGINAL ARTICLE

### LAPAROSCOPIC APPENDECTOMY; COST EFFECTIVE TECHNIQUE

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#### Abstract

**Background:** Appendectomy is one of the most common general surgical procedures and the most common emergency general surgical operation performed all over the world. In 1983, Kurt Semm performed the first successful Laparoscopic appendectomy (LA).

**Aim of the work:** The main limitations of LA are the longer operative time, which can be shortened by increasing skills and experience, and the increased cost, which can be minimized by adopting a modified low cost technique, which is the aim of our work.

**Patients and Methods:** One hundred and four patients were included in this study. All of them were having suspected appendicitis according to the clinical picture, Alvarado score, laboratory and ultrasonographic findings.

Patients were submitted to LA by using the modified technique with the details mentioned below. There was no need for the commercially used endo loops or endo GIA staplers.

The laparoscopic and histopathologic findings, the operative time and outcome are all recorded.

**Results:** For the included patients, three port technique was used in 74(71.2%) and two port technique in 30(28.8%) of them.

The Laparoscopically inflamed appendix was found in 89(85.65%) and the histopathologically inflamed was confirmed in 92 (88.5%).

Concurrent pathology was found in 12(11.5%) and different pathology in 9 (8.7%).

The mean operative time of LA only was 42 minutes, and 95 minutes when other procedure was added.

Complications were reported in three cases. Conversion rate was 10.6%.and there was no mortality.

**Conclusion:** With this modified technique, we found Laparoscopic appendectomy is safe, cost effective and efficient, and we recommend it as first choice approach if not contraindicated.

**Keywords:** Laparoscopic appendectomy, different techniques, low cost.

## INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdomen in surgery.

Its incidence is roughly 6-12% and the life time risk is about 8%.<sup>(1)</sup>

Appendectomy is one of the most common general surgical procedures and the most common emergency general surgical operation performed all over the world.<sup>(2)</sup>

Reginald Fitz coined the term Appendectomy for removal of inflamed appendix as a cure in 1886.<sup>(3)</sup> Since then, Morton (1888), Mc Burney (1889), Murphy (1904) and others have published their experience of open appendectomy as a treatment of acute appendicitis and, after wards, open appendectomy has become the gold standard of treatment of acute appendicitis.<sup>(4)</sup>

In 1983, Kurt Semm performed the first successful Laparoscopic appendectomy (LA). Schreiber another German gynecologist reported his small series of LA for acute appendicitis. After the report of 625 cases of LA by Pier and his coworkers in 1991, the role of Laparoscopy for appendicitis became popular.<sup>(3)</sup>

Because of the advancement in surgical techniques and instruments, Laparoscopic appendectomy has attained very much preference by most of Laparoscopic Surgeons at least in developed countries. This is due to the advantages of LA in giving wide abdominal exploration, more accurate diagnosis, detection of other pathology and dealing with it in most of the cases, Less post-operative pain and subsequent need for analgesics, short hospital stay, rapid recovery and return to work, better cosmetic appearance and more patient satisfaction, as being reported by many authors.<sup>(5-8)</sup>

The main limitations of LA are the longer operative time and the increased cost.<sup>(5,9)</sup> However the time is usually markedly shortened by increasing skills and experience of the surgeon, especially after passing the learning curve (usually the first 20 cases of LA).<sup>(9)</sup>

Many of the reviewed literatures have attributed the increased cost of LA mainly to the use of commercially available endo-loops, endo-GIA staplers and the single use instruments. So, if these factors can be modified to non-expensive tools, the cost will be markedly reduced, as have been tried by many Surgeons.<sup>(1, 3, 9,10)</sup>

The aim of our work is to apply a non-expensive technique of LA, which is safe and available in developing countries, making the patients enjoying the advantages of the procedure and minimizing the disadvantages.

## PATIENTS AND METHODS

One hundred and four patients of suspected acute

appendicitis have been admitted to Yanbu National Hospital, KSA. Within the period from June, 2008 to August, 2010. These patients are included in the study according to the exclusion criteria of Alvarado score less than 6, evidence of generalized peritonitis and third trimester pregnancy. of these patients, 60 were males and 44 were females. Their age ranged from 10 to 52 years with the mean of 22 years. In the female group, 32 were in the child bearing age and 12 were before puberty.

For all patients, detailed medical history was taken and physical examination, general and local, was carried out. Complete blood counts (CBC), CRP, ESR, pancreatic amylase and/ or lipase were done to all of them, and pregnancy test was added to females of child bearing age. Abdomino – pelvic ultrasonography was done to all of them to detect the inflamed appendix, appendicular mass, fluid collection or other pathology.

We relied mainly on clinical assessment in diagnosis of acute appendicitis. All of the included patients, were having Alvarado score 6 or more.

After preparation of the patient, an informed consent for diagnostic Laparoscopy and proceeding according to the finding including surgical removal of the appendix and possibility of conversion to open, was obtained.

In the operating room , the patient was lied down in supine position, second generation cephalosporine or ampicillin sulbactam, and metronidazole were given intravenously during induction of anesthesia . Urethral catheter was inserted and removed at the end of the procedure. After scrubbing, wrapping and examination under anesthesia we have adopted the 3 port technique in 74 cases.

The first umbilical 10 mm port was inserted by the open method, through which gas insufflation was done and 0° telescope was inserted to inspect the interior of the abdomen. Another two of five mm port (one suprapubic and another at a point midway between the umbilicus and left anterior superior iliac spine) were inserted under vision.

We found these port sites more convenient to the surgeon and to prevent overcrowding of the surgeon's hands and hands of the assistant holding the camera.

After that, the operating table was adjusted in Trendelenburg position and tilted to the left to displace the bowel away from the right iliac fossa.

After exploration, the appendix is grasped and the meso appendix is divided by judicious hook diathermy (monopolar) through taking small bites close to the wall of the appendix.

Near to the base of the appendix, the remaining part of the mesoappendix is gently dissected down. If meso appendix is short, bipolar diathermy is used.

The base of the appendix is ligated by self-made endoloops through making extracorporeal Roder's knot, introduced into the abdomen, then the appendix is enclosed into the loop and the knot is tied by knot pusher.

Two loops are applied proximal and one distal to the site of division.

The 10mm telescope is then replaced by 5mm one to be introduced through a 5mm port and the appendix is withdrawn into the 10 mm port to be removed all together.

The stump of appendix is cauterized carefully by the tip of the hook.

If there is collection or soiling, the area is irrigated and aspirated, and a drain may be fixed according to the severity of inflammation. Ports are then removed under vision, after ensuring hemostasis and absence of other pathology and abdomen is then deflated. The sheath of the umbilical port site is closed with sutures and the skin of all port sites is approximated with adhesion tapes. Re-usable instruments were used in the procedure. Post operatively, further two doses of antibiotics are given during the first 24 hours, which may be extended according to the severity of infection until no fever and no leukocytosis.

Oral liquids are gradually introduced 6 hours post-operatively and increased when tolerated. The patient is discharged home when there is no fever and /or leukocytosis, there is open bowel and pain can be controlled by simple oral analgesics.

Follow up is arranged after 3 days then after one week.

## RESULTS

This study has included 104 patients. Their age ranged from 10 to 50 years with a standard deviation (SD) of  $\pm 6$  years.

Among the included patients, 60 were males (57.7%) and 44 females (42.3%). In the female group, 32 were in the child bearing age (72.7% of the female group) and 12 were before puberty (27.3% of the female group). All of the included patients were having right lower abdominal pain (RLA) and tenderness. Rebound tenderness was absent in 28 patients (26.9%) and

temperature was  $\leq 37.4$  in 24 (23.1%). Anorexia was found in 68 (65.4%) Leukocytic count was less than 11,000/mm<sup>3</sup> in 21 patient (20.2%) and CRP was negative in 10 (9.6%).

Ultrasonography with positive finding (inflamed appendix, pelvic collection, distended bowel loops with sluggish peristalsis or ovarian cyst) was found in 60 patients (57.7%).

## Laparoscopic findings were as follows:

Apparently congested and distended appendix with omental shift and peritoneal reaction in 63 patients (60.6%), dissectible appendicular mass in 10 (9.6%), perforated appendix with frank pus in pelvis and right iliac fossa 11 (10.6%), kinked appendix periappendicular adhesion in 5 (4.8%), associated pathology in the form of lower abdominal and/or pelvic peritoneal adhesions, congenital band, sizable ovarian cyst, subserous uterine fibroid, polycystic ovary and chronic salpingitis were found in 12 (11.5%). Apparently normal appendix with the presence of other pathology in the form of peritoneal adhesions, acute PID (pelvic inflammatory disease), ruptured ovarian cyst and omental infarction, were found in 9 (8.7%). Apparently normal appendix with no detectable other pathology was found in 6 (5.8%). Acute appendicitis has been histopathologically confirmed in 92 (88.5%). Of those with apparently normal appendix (9+6), three of them were found histopathologically inflamed in four cases the appendix was apparently and histopathologically normal and no other pathology detected.

In cases of grossly inflamed appendix (89 cases), histopathological examination has confirmed the diagnosis in 87 of them (97.8%) and two (2.2%) were diagnosed as periappendicitis secondary to acute PID.

In cases with grossly normal appendix (15 cases), three of them only proved to be histopathologically inflamed (20%).

Two port Laparoscopic appendectomy, umbilical and suprapubic, was done in 30 cases (28.8%) where the appendix and caecum were found mobile allowing the appendix to be delivered through the 10mm umbilical port to be dealt with as in open technique. In the remaining cases the three port technique was found necessary.

The operative time for Laparoscopic appendectomy only ranged from 25-85 minutes with the mean of 42 minutes. However when other Laparoscopic procedure has been added, the time ranged from 70 - 125 minutes with the mean of 95 minutes. Eleven cases have been converted to open (10.6%) because of tissue friability, expected unsafe dissection by Laparoscopy, bleeding which could not be found safe to be laparoscopically controlled and when there was generalized peritonitis.

Tube drainage was found necessary in 13 cases (12.5%) because of appendicular perforation and/ or collection of pus. Post - operative hospital stay in Laparoscopic only procedures ranged from 16-36 hours with the mean of 20 hours.

On the other hand, the time was prolonged from 1-4 days with the mean of 2 days in cases where the procedure was converted to open and/or tube drain was fixed.

One intra- operative complication in the form of bleeding from a retracted appendicular artery was reported, for which, conversion to open procedure to control bleeding was done.

abscess which has been drained 2 weeks post-operatively with the ultrasonic guidance , and two cases of wound infection which have been treated with dressing and antibiotics.

Three post- operative complications have been reported all in the converted to open cases; one case of pelvic

There was no mortality in the included cases.

**Table 1. The following table summarizes the clinical, laboratory and ultrasonographic characteristics of the included patients.**

Characteristics	Present %	Absent %
RLA pain and tenderness	104 (100%)	0 %
Rebound tenderness	76 (73.1%)	28 (26.9%)
Temperature $\leq$ 37.4°C	24 (23.1%)	80 (76.9%) *
Anorexia	68 (65.4%)	36 (34.6%)
Leukocytic count 11,000 or more	83 (79.8%)	21 (20.2%)
Raised CRP	94 (90.4%)	10 (9.6%)
Ultra sonographic findings	60 (57.5%)	44 (42.3%)

\* In these patients, temperature was more than 37.4 °C.

**Table 2. Laparoscopic findings in the studied cases of suspected appendicitis.**

Lap findings	Number of cases	%
Grossly inflamed appendix without complication.	63	60.6
Dissectible appendicular mass	10	9.6
Perforated appendix with peritonitis	11	10.6
Kinked appendix with periappendicular adhesion	5	4.8
Associated pathology	12	11.5
Grossly normal appendix with other pathology.	9	8.7
Grossly normal appendix with no other pathology detected.	6	5.8

**Table 3. Condition of the appendix.**

Characteristics	No. of patients	%
Grossly inflame	89	85.6
Histopath. inflamed	92*	88.5
Grossly normal	15	14.4
Histopath. normal	12	11.5

**Table 4. Complications of the procedures.**

Complication	Laparoscopic		Converted to open	
	Intra-op.	Post – op.	Intra – op.	Post – op.
Bleeding	+	-	-	-
Wound infection	NA	-	NA	++
Pelvic abscess	NA	-	NA	+

NA=Not applicable.

## DISCUSSION

Minimal surgical trauma, better visualization of intra-abdominal viscera, less post-operative pain, small wounds with better cosmetic results, less incidence of wound infection and early return to normal activity have made Laparoscopy very popular nowadays. Despite all of these advantages, LA has not gained that much popularity to reach the status of gold standard. This may be attributed to unavailability of Laparoscopy set in emergency operating room in many hospitals, relatively prolonged learning curve, unavailable Laparoscopic surgeon outside the duty hours and a relatively high cost of LA. (11). If these four points are solved, LA will be the first choice procedure in the very near future. The aim of this trial is to adopt a safe and low cost technique for LA.

As it is well known, the high cost comes from use of expensive tools like disposable instruments, endo-staplers and endo-loops. So, in this technique we used reusable instruments, we did not use endo stapler or

endo GIA and divided the mesoappendix with monopolar or bipolar diathermy close to appendix has been used by many authors.<sup>(3,7,10,18)</sup>

Handmade sliding knot to be tied by knot – pusher was used to doubly ligate the appendicular base. We did not use endo-bag to remove the appendix, but it is removed through the 10mm cannula without touching any surrounding tissue. In 30 cases we found the appendix and cecum can be mobilized enough, so by two port technique the appendix was extracted from the 10mm umbilical port- site and dealt with as in open technique, as have been applied by some trials.<sup>(13,14)</sup>

We did not use clips to control the base of the appendix because of fear of slipping which has been reported by some authors.<sup>(15)</sup>

In the current study we found a grossly normal appendix by Laparoscopy in 14.4% which is close to a 16% reported by other series.<sup>(11,19)</sup>

The operative time in this work ranged from 25–85

minutes with the mean of 42 minutes which is comparable to many series.<sup>(1,17,18)</sup> Conversion rate from 0% to 39% has been reported.<sup>(1,4,7)</sup>

Our conversion rate was 10.6%. In our trial we reported one intra – Operative complication which was bleeding from a retracted appendicular artery (0.96%), and three post-operative complication (1.9%) two of them were wound infection and one case of pelvic abscess (0.96%), and these were found similar to other reports.<sup>(4,7,10)</sup>

Among the grossly normal cases, 20% was found histopathologically inflamed in our study, while in other two series it is 3.2% - 25% respectively.<sup>(20,21)</sup>

About 306 cases of omental infraction mimicking appendicitis in children have been reported till now all over the world.<sup>(22,23)</sup>

In our present series one case of omental infraction was recorded and clinically diagnosed as acute appendicitis.

Concurrent pathology with inflamed appendix was recorded in 11.5% and different pathology with normal appendix in 8.7% of our series.

In other literatures, 12% for concurrent pathology and 17.7% for different pathology was reported.<sup>(24,25)</sup> The higher percentage of different pathology in that literature can be attributed to the higher female percentage, operative time and complications.

Hospital stay ranged from 1-7 days with the mean of 1.5 to 2.5 days in many studies.<sup>(1,10,11,18)</sup>

In our work it ranged from 1-2 days for LA and from 1-3 days for the converted cases and /or when drain was fixed.

There was no mortality in our series but 0.3% was recorded in another series.<sup>(19)</sup>

In conclusion, with this modified technique, we found Laparoscopic appendectomy is safe, cost effective and efficient, and we recommend it as first choice approach if not contraindicated.

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## المخلص العربى

### استئصال الزائده الدوديه بالمنظار الجراحى

#### بطريقه أقل تكلفه

بحث بواسطة

دكتور: محمد أحمد سعيد

قسم الجراحة العامه-كلية الطب بنين - القاهره

جامعة الأزهر

إن عملية استئصال الزائده الدوديه تعد من أكثر العمليات الجراحية حدوثاً، بل أكثر العمليات الطارئة فى الجراحة العامه على مستوى العالم .

ويعد العالم كرت سم هو أول من أجرى عملية ناجحه لاستئصال الزائده الدوديه بالمنظار الجراحى سنة 1983.

غير أن إجراء هذه العملية بهذه الطريقه يعتبر أكثر تكلفه بسبب استعمال بعض الأدوات ذات الإستعمال مرة واحدة أو غالية الثمن مثل الدباسة الجراحية المنظارية وغيرها.

لذا، فقد عنيت هذه الدراسة بكيفية إجراء هذه العملية بطريقه أقل تكلفه مع الإحتفاظ بمزايا إجراء الجراحة بالمنظار.

وذلك عن طريق استعمال الآلات والأدوات التى يمكن إعادة تعقيمها ومن ثم استعمالها مرات أخرى.

وعن طريق استعمال وسائل وآليات أخرى بديله للآليات غالية الثمن، غير أنها متوفره أكثر فى غرف العمليات وأقل تكلفه.

وقد استعملت هذه الطريقه فى مائه وأربع حالات كانوا يعانون من التهاب حاد أو اشتباه التهاب حاد بالزائده الدوديه وذلك بمستشفى ينبع الطنى بالمملكة السعوديه فى الفترة ما بين يونيه 2008 إلى أغسطس 2010.

حيث تم تشريح الزائده الدوديه باستعمال جهاز الكى الكهربائى أحادى القطب أو ثنائى القطب وربط قاعدة الزائده الدوديه بالخيط الجراحيه.

وقد نجحت هذه الطريقه فى إتمام إجراء العمليه بالمنظار فى 89.4% من الحالات، وتحويلها إلى الطريقه التقليديه المفتوحه فى 10.6%.

كما سجلت بعض المضاعفات فى 3.8%، ولم تسجل وفيات.

وقد خلصت هذه الدراسة إلى أن إجراء هذه العمليه بهذه الطريقه هو إجراء آمن وفعال وأقل تكلفه، مع الإحتفاظ بمزايا إجراء مثل هذه العمليه الجراحية بواسطة منظار البطن الجراحى.