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Research Article

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A Snapshot of Variations in Techniques of Laparoscopic Appendectomy Among Egyptian Surgeons

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Abstract

Background: *Acute appendicitis is one of the common surgical emergencies. This study aims to highlight the variations in the Laparoscopic appendectomy (LA) techniques among Egyptian surgeons.*

Methods: *A retrospective search of patients who underwent LA for acute appendicitis, from 1st October 2019 to 31st December 2019, then a group of surgeons was asked to complete a questionnaire aiming to evaluate the variation of techniques of LA & compare it against our own practice, and available literature.*

Results: *During the period from 1st October 2019 till 31st December 42 patients had LA during this period at Kobri Kobba Armed Forces Hospital. Out of 120 surgeons who received the questionnaire, only 116 Surgeons responded to the questionnaire; only 41 of them have experience in LA.*

Conclusion: *Laparoscopic appendectomy is a feasible safe technique in the management of acute appendicitis, even in complicated appendicitis. Considerable variation in techniques of LA among surgeons in Egypt.*

Keywords: *Laparoscopic appendectomy, mesoappendix, insufflation.*

1. Introduction

Acute appendicitis is one of the most common surgical emergencies worldwide, with an incidence rate of 5.7 to 50/100,000 in developed countries [1]. The classic approach was open appendectomy till the introduction of minimally invasive surgery. Semm first described laparoscopic appendectomy (LA) in 1983, which now represents the gold standard treatment of acute appendicitis, especially in females during the childbearing period [2].

In the review of the literature, we found a lot of differences in many key steps in LA techniques, such as the use, and timing of antibiotics, access to the peritoneal cavity, scope size, and angle, use of peritoneal lavage, controlling of mesoappendix and method used to control the appendicular stump.

The main aim of this study is to highlight the variability in techniques of LA among Egyptian surgeons.

2. Patients & Methods

A retrospective search for patients who had undergone LA during the period from 1st October 2019 to 31st December 2019 at Kobri Kobba Armed Forces Hospital, Cairo, Egypt. The records were searched for patients' gender, age, operative notes, actual operative time, presence of complicated appendicitis (gangrene, perforation, pelvic collection, appendicular mass and/or abscess, peritonitis), and incidental findings other than appendicitis, hospital stay, and occurrence of surgical site infection (SSI).

A group of surgeons asked to complete a questionnaire form using Google Forms.

The questionnaire was composed of two sections; the first section aims at gathering information about the qualifications, and skills of the surgeons, and the second part gathers the key steps of their technique of LA. The questionnaire was designed as a two-step process, which requires the respondent to have a certain degree of experience to be able to proceed to the second part of the questionnaire.

3. Results

During the period of the study 42 patients had LA; 33 males, and 9 females with a mean age of 20 years, all patients underwent LA. The cases had been operated on using a three-port technique (11-12 mm supraumbilical for optics, 5mm at the left iliac fossa, & 5mm either suprapubic or in the right hypochondrium). The optical trocar introduced using the Hasson open technique, followed by the introduction of the other two ports under direct vision. The insufflation pressure used was 12 mm Hg except in two cases where the pressure was set at 9 & 10mm Hg in a young adult female and a 26-week pregnant female respectively. The CO_2 flow was set at 3 liters per minute in all cases. The suprapubic port was used only in three cases while in the remaining cases, the right hypochondrium port had been used. All cases operated using a 5mm 30-degree angled scope**.** Whenever a collection had been found the main technique was to aspirate such collection with no, or minimal lavage (50-100

ml saline) ensuring aspiration of all lavage fluid, except one case where there was copious irrigation used (1500 ml saline).

11 patients (8 males, & 3 females) presented with a picture of complicated appendicitis as follows; four cases with pelvic collection, two cases of diffuse peritonitis, one case for each of the following appendicular mass; perforated appendix, abscess, gangrenous appendix and Peri-appendicular abscess (abscess within the mesoappendix). Out of the nine female patients, one was pregnant at 26 weeks of gestation.

The drain had been used only in two cases; one case of perforated gangrenous appendicitis with diffuse peritonitis as the surgeon was not confident, he retrieved all the faecolith, and the other one was a female who had Peri-appendicular abscess, & considerable pelvic adhesions secondary to previous multiple caesarian sections as stated by operative notes.

Regarding the method of controlling the appendicular artery, in 30 cases an advanced energy device was used (Ultrasonic device, Harmonic®, or Ligaure®), while monopolar electrocautery (ME), was used in the remaining 12 cases. The base of the appendix was controlled using 2x extracorporeal Miltzer's knot endo-loop in 38 cases, & the premade endo-loop in 2 cases. The surgical stapler (Edndo GIA® 60mm cartilage) was used in two cases; the first one with a gangrenous base, & the second the endo-loop cut through the tissues due to increased tissue friability because of severe inflammation.

The mean operative time was 43 ± 12 minutes, and when doing a sub-group analysis of operative time, the mean operative time for uncomplicated cases showed significant decrease, while the mean operative time for the complicated cases was increased. Moreover, the operative time also decreased when using advanced energy to control the appendicular artery.

Regarding the incidental findings, three female patients where there was a right hydatid cyst of Morgagni, one case of occult right inguinal hernia, and one female patient with a bilateral developmental inguinal hernia.

All patients received a preoperative intravenous 2-gram of IV ceftriaxone, & 500mg of metronidazole, except the pregnant female who did not receive metronidazole. There were three cases with SSI, two patients developed umbilical port site infection (Clevien-Dido classification IIIa), which was managed by frequent daily dressings; while the third patient developed pelvic abscess (Clevien-Dindo classification IIIb), which was managed successfully by laparoscopic drainage & washout [3].

All the cases had been done as a day case surgery with a hospital stay of 23 hours or less, except four cases because of the need for intravenous antibiotics, & all were discharged after 48 hours. All patients were discharged on Co-Amoxiclav 1gm twice a day three times a day for 5 days.

The questionnaire link was sent to 120 Surgeons, and only 96.6% (n: 116) responded to the questionnaire. 55.2% (n: 64) of the respondents have eleven years or more of experience as a surgeon and 21.6% (n: 25) have between 5 and 10 years of experience and 23.3% (n:27) have less than 5 years. 36.2 % (n:42) of respondents hold a consultant position, 53.5% (n:62) are specialists and 10.3% (n:12) towards end of their training.

Regarding the qualification obtained, 33.6% (n: 39) have a PhD or equivalent degree, and those who hold a master's degree (MSc) or equivalents represented 62.9 % (n: 73), and 3 % (n: 4) do not hold higher qualifications

Out of the respondents, only 75.9% (n:88) reported having laparoscopic training as a part of their surgical training. Regarding laparoscopic experience. 45.7% (n:53) had operated on more than 50 cases of laparoscopic cholecystectomies; while 13.8% (n:16) had operated between 30 to 50 cases of laparoscopic cholecystectomies;13.8% (n:16) had operated between 10 to 30 cases of laparoscopic cholecystectomies, 7.8% (n: 9) operated 6 to 10 cases of laparoscopic cholecystectomy, and 19% (n: 22) operated 5 or less laparoscopic cholecystectomy.

However, only 35.3% (n:41) have experience in performing (LA), and those were able to complete the second part of the questionnaire. Out of those 39% (n:16) had operated 50 or more cases of LA, 7.3% (n: 3) had operated between 31-50 cases of LA,7.3 (n: 3) had operated between 11-30 case of LA, 14.6% (n:6) had operated between 6-10 cases of LA, and 31.7% (n:13) had operated between 1 to 5 cases of LA.

Regarding the approach to access the peritoneal cavity, 39% (n:16) used the open Hasson method, 29.3% (n:12) used the closed method, 29.3 (n:12) their cases were case-based, and only 1 used optical trocar. Regarding the type of the scope, the majority 63.4 (N:26) use a 10mm 30-degree scope, 29.3 (n:12) use a 10mm 0-degree scope, 4.9% (n:2) use a 5mm 30-degree scope, and only one uses 5mm 0-degree scope.

Regarding the insufflation pressure, the majority 56.1% (n:23) use high insufflation pressure between 14, & 15 mmHg, 39% (n:16) use a pressure of 12 mmHg, & 4.6% (n:2) use a pressure of 10.

Regarding the methods used to control the mesoappendix; 31.7% (n:13) report the use of either advanced bipolar or ultrasound device, followed by 29.3% (n:12) use of monopolar diathermy, 24.4% (10) use bipolar diathermy, 9.8% (n:4) uses clips, and 4.9% (n:2) use intra-corporeal knotting.

Regarding the control of appendicular stump; Most participants 48.8% (n: 20) use endo- 43.9% (n:18) use intra-corporeal knots, & only 7.3% (n:3) use clips.

Regarding the peritoneal lavage; The vast majority 92.7% (n:38) of participants reported the use of peritoneal lavage (irrigation) in case of peritonitis. The amount of fluid used for lavage ranges from over 4L in 22% (n:9), 2-4L in 26.8% (n:11), 1-2L in 26.8% (n:11), 0.5-1L in 17.1% (n:7), and minimal if any in 7.3% (n: 3).

Regarding the practice of using drain; only 24.4% (n:10) of participants use a drain as routine in their cases of LA.

Table 2: Data Analysis from surgeons participating in the questionnaire. (116 Surgeons).

Number of cases done by each surgeon		
	Number	Percentage %
>50	53	45.7
30-50	16	13.8
10-30	16	13.8
<10	31	26.7
Total	**116**	100
Years of Experience in participate		
>11 years	64	55.2
5-10	25	21.6
<5	27	23.2
Medical Degree		
Consultant	42	36.2
Specialist	62	53.4
Trainee	12	10.3
Qualifications		
PhD	39	33.6
MSc	73	62.9
No higher qualification	4	3.5
Laparoscopic Training		
Yes	88	75.9
No	28	24.1
Did Laparoscopy for appendectomy Complicated with Peritonitis		
Yes	41	35.3
No	75	64.7

Table 3: Data from Surgeons who operated LA cases (41 Surgeons).

Number of cases done by each participant		
Numbers of cases	Numbers Of Surgeons	Percentage %
>50	16	39
31-50	3	7.3
11-30	3	7.3
6-10	6	14.6
1-5	13	31.7
Total	**41**	
Techniques to access the peritoneal cavity		
Open	16	39
Close	12	29.3
Case-based (Both)	12	29.3
Optical Trocar	1	2.4
Type of the Scope		
10 mm 30-degree lens	26	63.4
10mm Zero Lens	12	29.3
5mm 30-degree lens	2	4.9
5mm Zero Lens	1	2.4
Insufflation Pressures (mmHg)		
14-15 mmHg	23	56.1
12 mmHg	16	39
10 mmHg	2	4.9
Control of Meso-appendix		
Bipolar Diathermy /Ultrasound	13	31.7
Simple bipolar diathermy	10	24.4
Monopolar electrocautery	12	29.3
Extra-Corporal Stitches	4	9.8

Intra-corporal Stitches	2	4.9
Ligation of the stamp		
Endo-loop	20	48.8
Intra-corporal stitches	18	43.9
Clips	3	7.3
Peritoneal Lavage		
Yes	38	92.7
NO	3	7.3
Amount of Saline used in Peritoneal Lavage		
4 litters(L)	9	22
2-4 L	11	26.8
1-2 L	11	26.8
0.5-1 L	7	17.1
No lavage	3	7.3
Use of Drain		
Yes	10	24.4
No	31	75.6

4. Discussion

Although open appendectomy was the classic treatment of acute appendicitis a long time ago, LA is the golden standard technique nowadays [4].

Although perioperative prophylaxis antibiotics are a well-established policy for reducing the risk of SSI. The optimal timing for this practice has yet to be precisely determined. Recent recommendations are antibiotics given preoperatively within 2 hours before skin incision not at the time of induction of anesthesia to be more effective, and to avoid interactions with anesthetic drugs [5]. In our study group, all patients received antibiotic preoperative in the form of intravenous 2 grams of ceftriaxone and 500mg of metronidazole (except the pregnant female).

The technique for trocar insertion, in our study group we introduce the first port using the Hasson open method, followed by the introduction of the other 2 ports under direct vision. The response of surgeons shared in the questionnaire is variable 39% used the open method without optical trocar, only 2.4%use optical trocar, 29.3% used the close method as a routine, and 29.3% used both techniques depending on the case.

The insufflation pressure used in our study was 12 mm Hg, the same in 39% of the surgeons in the questionnaire group, but 56.1% preferred to use a pressure of 15 mmHg, and 4.9% preferred to use low pressure of 10 mmHg.

All our study cases have been operated using a 5mm 30-degree angled scope. Although only 29.3% of surgeons in our questionnaire use the same, 63.4% use a 10 mm 30-degree angled scope, and 2.4% still use the Zero scope.

Profuse Peritoneal irrigation was traditionally used for a long time, the aim is to dilute and remove infected material without spreading the infection to the rest of the abdomen to reduce the chances of postoperative abscess formation, although the current studies failed to demonstrate a benefit. A systematic review done by Burini et al., 2021 reported that after appendectomy no statistical significance or advantage of peritoneal suction &irrigation and over suction-only to reduce the rate of peritoneal sepsis [6].

In our study cases, Peritoneal aspirate was done to aspirate any collection with no, or minimal irrigation with saline (50 – 100 ml) followed by ensuring suction of all fluid. in the questionnaire. In only one case in which the surgeon used irrigation with 1.5 L of saline & patient developed a pelvic collection that needed further laparoscopic drainage and washout. only 7.3% of surgeons did the same, but the majority 92.7% did lavage with different amounts of saline 26.8% used 1- 2 liters,26.8% used 2-4 liters, and only 17.1 used a maximum of one liter.

Profuse Peritoneal irrigation traditionally used for a long time, the aim is to dilute and remove infected material without spreading the infection to the rest of the abdomen to reduce the chances of postoperative abscess formation, although the current studies failed to demonstrate a benefit. A systematic review done by Burini et al., 2021 reported that after appendectomy no statistical significance or advantage of peritoneal suction &irrigation and over suction-only to reduce the rate of peritoneal sepsis [6]. This is in agreement with our own technique of using no or minimal lavage.

Although peritoneal drains are still commonly used, Greenall et al., 1978, a long time ago mentioned that Peritoneal drains are not necessary after an appendectomy for perforated appendicitis [7]. Also, Petrowsky et al., 2004, in a systematic review reported that many Gastrointestinal surgeries can be done safely without prophylactic drainage [8]. In our study, the drain had been used only in two cases with perforation & abscess. The same goes for surgeons in our questionnaire 75.6% prefer not to use a drain, and only 24.4% still put a drain as routine in all cases.

In our study the controlling of mesoappendix was done by ultrasonic device/ advanced bipolar diathermy mainly, the same was used by the surgeons in the questionnaire which reached 31.7%, but still, 29.3% used ME, and 14.7% used Stitches. Controlling of mesoappendix to secure the appendicular artery can be done by many methods such as monopolar diathermy, Endo-clip, and Harmonic scalpel. All three methods had acceptable complication rates. Monopolar diathermy was the most cost-effective method and, given the other similarities. Although the Harmonic scalpel had a significantly shorter operation time, the operation time of all three methods showed no significant statistical difference. [9].

Securing the appendicular stump during LA using endo-loop although it will take longer time than the use of endo-GIA, is associated with an equal, perioperative complication rate. The stump is typically not inverted after laparoscopic appendectomy LA [10]. Methods that are cheap and easy to apply should be considered as the first choice [11]. In our study ligation of the appendix stump was controlled using mainly endo-loop. The same was used by the questionnaire surgeons. 48.8% use the endo-loop, and 43.9% use intra-corporal stitches.

In the study by Adrian et al., 1995, the mean operative time was 66 ± 24 minutes. In our study group, the average operative time was 43 ± 12 minutes [12].

If an uninflamed appendix is encountered at appendectomy, it is important to search for other pathologies such as Crohn's disease, cancer caecum, Meckel's diverticulitis, mesenteric adenitis, or ovarian pathology in a female [13]. During appendectomy, the incidental finding is unusual pathologies are rare, and they can have an impact on patient outcome, in the study by Jahan et al., 2016 on 148 cases they found only one case of mucinous cystadenoma with low-grade dysplasia and two cases of carcinoid at the tip of the appendix [14]. In our study, one female patient had a right hydatid cyst of Morgagni and two cases with inguinal hernias.

Patients who undergo LA have a shorter length of hospital stay and fewer complications without increasing the inpatient care cost [15]. In our study, all patients were discharged after an average of 23 hours, except 4 cases which needed to stay for 48 hours

overall complication rates of appendectomy are variable, in Bhangu et al., study in 2017 it was 8.2 to 31.4%, mainly wound infection, and pelvic abscess [16]. In the study by Ceresoli et al., 2016 was 8%to 11 %. depending on the surgical technique [17].

In our study were three cases with SSI, two patients developed umbilical port site infection, and one developed a pelvic abscess managed successfully by laparoscopic drainage.

One of the main limitations of our study is the small sample of the case and the number of responses to the questionnaire. There is a need to have a large-scale multicenter future prospective study with more questionnaire responses from surgeons. However, this still gives a good idea about the variation of LA techniques among Egyptian surgeons.

Conclusion

There is a great variation of techniques for performing laparoscopic appendectomy among surgeons in Egypt. LA appendectomy is a safe and feasible option in managing acute appendicitis, even in cases of complicated acute appendicitis.

Author Contributions

Ashraf Elmetwally, operated patients, designed the study, & contributed to manuscript writing, data collection, and analysis. Sherreen Elhariri has contributed to writing of manuscript and critically reviewed the final draft.

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