LAPAROSCOPIC VERSUS OPEN APPENDICECTOMY IN THE MANAGEMENT OF COMPLICATED APPENDICITIS

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ABSTRACT:

***Background**: Laparoscopic appendicectomy (LA) is the preferred approach in uncomplicated appendicitis. However, in patients with complicated appendicitis (CA), the best approach is still unclear.*

***Aim of the work:** A prospective randomized study to compare the outcomes of LA and OA in management of CA regarding their efficacy, safety and postoperative complications.*

***Patients and methods:** 60 patients, admitted with a diagnosis of CA were divided into two groups, LA group and OA group, with 30 patients in each group. All patients were monitored for early and late post-operative complications with follow up in the out-patient clinics up to 12 month post-operative.*

***Results:** LA group had decreased incidence of postoperative surgical site infections (SSI) with comparable results regarding operative time, length of hospital stay, rates of hospital readmission and the need of re-operation. LA demonstrated considerable significant advantages over OA in CA regarding additional outcomes including decreased postoperative pain & increased cosmesis satisfaction.*

***Conclusion:** LA can be safely adopted in CA and can be performed safely with a low incidence of infectious complications.*

***Keywords:** Complicated appendicitis, laparoscopic appendices-tomy, open appendicectomy, post-operative complications.*

INTRODUCTION:

Acute appendicitis (AA) is one of the most common emergency surgical presenta-tions with a lifetime risk of 7%[(1)].

According to collected data, the annual incidence of AA is almost 90 per 100,000. CA, defined as histologically or intra-operatively diagnosed gangrenous or perforated appendicitis, suppurative appendicitis or appendicitis with an abscess or phlegmon formation, periappendicular mass or fecal peritonitis, represents around ⅓ of all cases It is more likely at the extremes of age, occurring in approximately 40% of patients under 10 years and 50% of those over 50 years[(2)].

Moreover, appendicular abscess and phlegmon have been associated with high risk of morbidity following operative intervention including wound infection, ileus, pelvic abscess and re-operation although mortality is less than 1% with good clinical prognosis[(3)].

Whilst appendicectomy for the treatment of uncomplicated appendicitis (UA) has been the mainstay of treatment, its role in CA including appendicular abscess and phlegmon has been unclear[(4)].

As a result, several reviews have recommended conservative initial management with antibiotics and/or radiological drainage as a safe treatment[5].

However, the role of LA in the management of patients with CA remains controversial. For cases with CA, LA has replaced OA in many centers dueto decreased blood loss, reduced postoperative pain and hospital stay, fewer overall complications, and an earlier return to usual activities[6].

Over the last three decades with the advent of laparoscopic surgery and the more widespread use of laparoscopy, CA has been increasingly managed laparoscopically, with up to 67% of cases of CA performed laparoscopically in 2011 in the USA[7].

Some concerns have been raised in the past though in relation to a potential higher rate of intra-abdominal abscesses (IAA) in the laparoscopic group compared to the open group[8].

AIM OF THE WORK:

A prospective randomized study to compare the outcomes of LA and OA in management of CA regarding their efficacy, safety and postoperative complications.

PATIENTS AND METHODS:

This study included 60 patients, who were admitted to Ain Shams University hospitals, Cairo, Egypt with a diagnosis of CA. An informed written consent was taken from all patients who accepted to participate in our study as mandated by the Ethical Committee of the Faculty of Medicine, Ain Shams University.

1- **Group A (LA group):** This group is composed of 30 patients with CA undergoing LA

2- **Group B(OA group):**This group is composed of 30 patients with CA undergoing OA

Patients with UA, history of cirrhosis and/or coagulation disorders, shock on admission, patients with absolute contra-indication to laparoscopic surgery (large ventral hernia, history of lower midline laparotomies, ascites), inability to give informed consent because of mental disability and pregnant females were excluded from the study.

Surgical procedure: OA: involved a muscle splitting gridiron incision at Mc Burney's point. The muscle layers were separated along the line of the fibres allowing for the identification and opening of the peritoneum. Upon entry into the peritoneum the caecum was identified and appendix was located. This can be achieved through using the merging of the teniae coli as a reference point. The vessels in the mesoappendix were ligated until the appendix was free. The base of the appendix could then be ligated with two loops of absorbable sutures and the appendix divided between the two loops. The appendix could then be removed. After ensuring haemostasis, a thorough wash was carried out. The wound was then closed in layers. The incision was extended or a mid-line incision was done if needed.

LA: The patient was placed in a Trendelenburg position, with a slight rotation to the left. Pneumoperitoneum was produced by continuous pressure of 10-14 mmHg of carbon dioxide via a Verres canula, positioned in the sub-umbilical area. Alternatively, a 10 or 12 mm port could be introduced by the Hasson's technique for initial insufflations of gas. Following gas insufflation, a 10 or 12 mm port for the 30 degree angled laparoscope was placed in the peri-umbilical area. A 5 or 10 mm was placed in the suprapubic area at the midline point to accommodate the grasping or and/or to facilitate specimen extraction, and a third 5 mm port in the left lower abdominal quadrant was introduced under direct vision.

The mesoappendix was identified and divided with bipolar forceps or mono-polar diathermy and scissors. Alternatively, it could be divided using clips, ligature or energy sealing devices. The base of the appendix was secured with one or two ligating loops of absorbable sutures placed at the base of the appendix close to the caecum. This was followed by blunt dissection distal to the second loop using a curved dissector. The appendix was then divided between the 2 loops. In all cases, the specimen was removed through the trocar without contact with the wound. The procedure was terminated by abdominal desufflation and removal of all ports.

The patients started clear liquid diet when flatus is observed and were advanced to regular diet when the liquid diet was tolerated. Patients were discharged when they tolerated a regular diet, had a normal white blood cell count (WBC) under 10,000/mL, and were a febrile for 24 hours.

All patients were monitored for early and late postoperative complications and followed up in the outpatient clinic for 12 months. The operative time, rate of conversion to open approach, early and late complications, length of hospital stay, assessment of post-operative pain after 12 and 24 hours, assessment of cosmetic outcome and histopathological results were all recorded and tabulated for statistical analysis.

Statistical Analysis: Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when parametric and median, inter-quartile range (IQR) when data found non-parametric. Also, qualitative variables were presented as number and percentages.

The comparison between groups regarding qualitative data was done by using Chi-square test and/or Fisher exact test when the expected count in any cell found less than 5.

The comparison between two independent groups with quantitative data and parametric distribution was done by using Independent t-test, while with non-parametric distribution were done by using Mann-Whitney test.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: P-value > 0.05: Non significant (NS), P-value < 0.05: Significant (S), P-value < 0.01: Highly significant (HS).

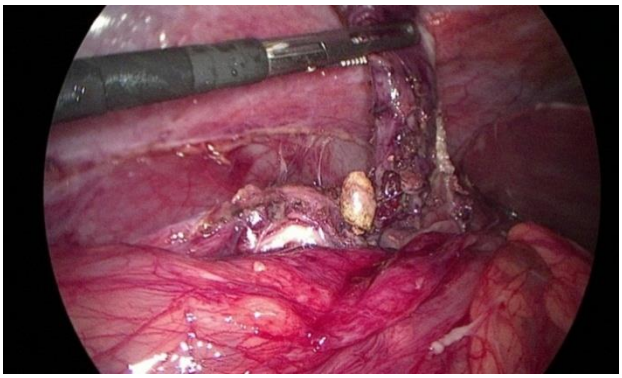

Figure (1): Perforated appendix with extruded large fecoltih

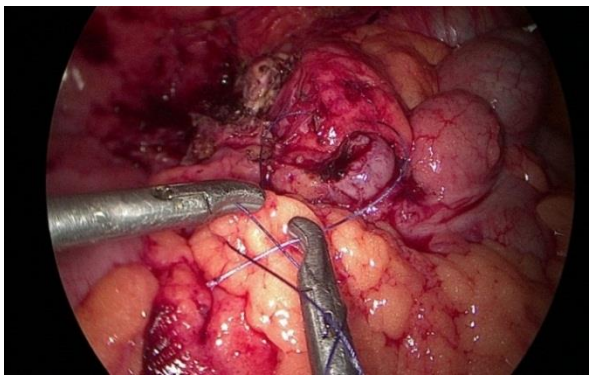

Figure (2): Omental patch technique over the appendicular stump

Figure (3): Appendix and huge right ovarian cyst excised via laparoscopic approach.

Figure (4): Right hemicolectomy done for an appendicular mass involving ceacum

RESULTS:

Patients' demographics: The demographic data and medical comorbidities of studied patients are represented in diagrams 1 and 2 respectively.

A complete blood count (CBC) was done to all patients on admission, where the WBC in all patients ranged from 4400-28600/mm3 with a mean of 14.29 ± 4.81 x 10^9/L. The range of WBC in LA group was from 5-25.8 x 10^9/L with a mean of 13.23 ± 4.56 10^9/L. Leukocytosis was present in 25 patients (83.3%) while normal WBC was present in 5 patients (16.7%) in this group. In the OA group the WBC range was from 4.4 – 28.6 x 10^9/L with a mean of 15.35 ± 4.89 x 10^9/L. Leukocytosis was present in 27 patients (90%) and normal WBC was present in 3 patients (10%) in this group.

Table (1): Comparison between laparoscopic and open groups regarding demographic data of the studied patients.

		Laparoscopic group No. = 30	Open group No. = 30	Test value	P-value	Sig.
Age	Mean ± SD	34.03 ± 14.64	27.37 ± 12.11	1.922•	0.059	NS
	Range	14 – 64	12 – 55			
Age (10-20)		6 (20.0%)	11 (36.7%)	3.404*	0.493	NS
Age (21-30)		8 (26.7%)	7 (23.3%)			
Age (31-40)		8 (26.7%)	7 (23.3%)			
Age (41-50)		4 (13.3%)	4 (13.3%)			
Age >50		4 (13.3%)	1 (3.3%)			
Sex	Female	17 (56.7%)	8 (26.7%)	5.554*	0.018	S
	Male	13 (43.3%)	22 (73.3%)			
BMI	Mean ± SD	26.20 ± 5.39	25.37 ± 4.80	0.633•	0.529	NS
	Range	18 – 41	18 – 35			
BMI <18.5 (underweight)		1 (3.3%)	1 (3.3%)	1.516*	0.911	NS
BMI 18.5 - 24.9 (Normal)		12 (40.0%)	13 (43.3%)			
BMI 25 - 29.9 (pre obesity)		11 (36.7%)	11 (36.7%)			
BMI 30 - 34.9 (obesity I)		3 (10.0%)	4 (13.3%)			
BMI 35 - 39.9 (obesity II)		2 (6.7%)	1 (3.3%)			
BMI >40 (obesity III)		1 (3.3%)	0 (0.0%)			

Table (2): Shows medical comorbidities within patients included in our study.

		Laparoscopic group	Open group	Test value	P-value	Sig.
		No. = 30	No. = 30			
Medical comorbidities	Free	23 (76.7%)	25 (83.3%)	0.417*	0.519	NS
	DM	2 (6.7%)	2 (6.7%)	0.000*	1.000	NS
	Hypertension	5 (16.7%)	0 (0.0%)	5.455*	0.020	S
	Rheumatoid arthritis	0 (0.0%)	1 (3.3%)	1.017*	0.313	NS
	TB	1 (3.3%)	0 (0.0%)	1.017*	0.313	NS
	FMF	0 (0.0%)	1 (3.3%)	1.017*	0.313	NS
	1ry amenorrhea	1 (3.3%)	0 (0.0%)	1.017*	0.313	NS
	HCV	0 (0.0%)	1 (3.3%)	1.017*	0.313	NS

Operative details: Regarding the operative time in this study, the range was from 35 – 240 minutes with a mean ± SD of 103.00 ± 47.53 minutes. The operative time range in the LA group was 45 – 225 minutes with a mean ± SD of 109.17 ± 47.80 minutes while in the OA group the range was 35 - 240 minutes with a mean ± SD of 96.83 ± 47.26 minutes. Although the operative time in LA group was slightly higher than the OA group yet it was not statistically significant (P-value = 0.319) Table (3).

Table 3: Operative time in minutes in the OA and LA groups.

		Laparoscopic group	Open group	Test value	P-value	Sig.
		No. = 30	No. = 30			
Operative time	Mean ± SD	109.17 ± 47.80	96.83 ± 47.26	1.005•	0.319	NS
	Range	45 – 225	35 – 240			

Incidence of patients converted from LA to open surgery in the LA group was 10% (n=3/30). The intra-operative findings in both groups are demonstrated in table (4). There were no statistically significant differences between both groups regarding different intra-operative findings except for the presence of an appendicular mass in the LA group (n=17/30) (23.3%) more than in the OA group (n=4/30) (13.3%) with a high statistical significance (P-value = 0.000).

Additional intra-operative findings were detected in 13 patients in the study, 9 in the LA group and 4 in the OA group. In the LA group one patient had a gangrenous bloodless fold of Treitz, a patient with omental infarction, a patient with a large right ovarian cyst, a patient with associated bilateral pyosalpinx, a patient with gangrenous ceacum, a patient with bilateral polycystic ovaries (presented to us with 1ry amenorrhea), a patient with posterior abdominal wall abscess and two patients with chronic calcular cholecystitis. In the OA group, one patient had a gangrenous ceacum and 2 female patients had a right ovarian cyst.

Table (4): Comparison between LA and OA groups regarding intra-operative findings.

	Laparoscopic group	Open group	Test value	P-value	%	Test	P	Sig.
	No.	No.	%	No.		value	value	
Operative finding	Appendicular mass	17	56.7%	4	13.3%	12.381*	0.000	HS
	Appendicular abscess	7	23.3%	11	36.7%	1.270*	0.260	NS
	Perforated appendix	13	43.3%	14	46.7%	0.067*	0.795	NS
	Gangrene of the appendix	3	10.0%	4	13.3%	0.162*	0.688	NS
	Suppurative appendicitis	0	0.0%	1	3.3%	1.017*	0.313	NS
	Grossly inflamed appendix	3	10.0%	7	23.3%	1.920*	0.166	NS
	Appendicoltih	4	13.3%	1	3.3%	1.964*	0.161	NS
	Adhesions	3	10.0%	1	3.3%	1.071*	0.301	NS
	Pelvic abscess	1	3.3%	5	16.7%	2.963*	0.085	NS
	Pelvic collection	8	26.7%	9	30.0%	0.082*	0.774	NS
	Suppurative peritonitis	7	23.3%	5	16.7%	0.417*	0.519	NS
	Other findings.	9	30.0%	4	13.3%	2.455*	0.117	NS

Complications: Table (5) shows the incidence of complications in both groups according to their time of occurrence. Intra-operative complications occurred only in the OA group which was statistically significant when compared to LA group (P-value= 0.038). There were no differences between OA and LA and groups regarding peri-operative and post-operative/ delayed complications with P-values =0.313 and 0.260 respectively.

There was a statistically significant higher incidence of superficial SSI in the OA group (13.3%) with P-value = 0.038. however there were no significant differences between the 2 groups regarding the incidence of drain problems, fever, ileus, intestinal obstruction, deep (organ space) infections, hospital readmission, re-operation and incisional hernia occurrence table (6).

Table (5): Comparison between LA and OA groups regarding complications encountered in both groups

		Laparoscopic group		Open group		Test value	P-value	Sig.
		No.	%	No.	%			
Complications	Peri-operative	1	3.3%	0	0.0%	1.017*	0.313	NS
	Intra-operative	0	0.0%	4	13.3%	4.286*	0.038	S
	Delayed/post-operative	7	23.3%	11	36.7%	1.270	0.260	NS

Table (6): Comparison between LA and OA groups regarding post-operative complications.

Post-operative complications	Laparoscopic group		Open group		Test value*	P-value	Sig.
	No.	%	No.	%			
Increased drainage	1	3.3%	0	0.0%	1.017	0.313	NS
Prolonged drainage	1	3.3%	0	0.0%	1.017	0.313	NS
Fever	3	10.0%	7	23.3%	1.920	0.166	NS
Ileus	0	0.0%	2	6.7%	2.069	0.150	NS
Intestinal obstruction	0	0.0%	1	3.3%	1.017	0.313	NS
Superficial SSI	0	0.0%	4	13.3%	4.286	0.038	S
Deep (organ space) infection	2	6.7%	0	0.0%	2.069	0.150	NS
Readmission	1	3.3%	0	0.0%	1.017	0.313	NS
Re-operation	1	3.3%	1	3.3%	0.000	1.000	NS
Incisional hernia	1	3.3%	0	0.0%	1.017	0.313	NS

Post-operative outcomes: There was a statistically high significant difference between LA group and OA group regarding pain score after 12 hrs with median and inter-quartile range (IQR) of 5 (5 – 6) Vs 7 (6 – 8) respectively (P-value = 0.000). There was also highly significant difference in pain score after 24 hrs between LA group and OA group with median and IQR of 3(3-4) and 4(3-5) respectively (P-value =0.002).

There was no difference between both groups regarding hospital stay with median and IQR of 3.5(2-4) and 4(3-7) in the LA and OA groups respectively (P-value =0.066).

There was a statistically high significant difference between LA and OA groups regarding the visual analogue score (VAS) for cosmetic outcome with median and inter-quartile range (IQR) of 5 7(6 – 8) in LA group and 6 (4 – 7) in the OA group (P-value = 0.002). There was also a highly significant difference in pain score after 24 hrs between LA group and OA group with median and IQR of 3(3-4) and 4(3-5) respectively (P-value =0.002) table (7).

Table (7): Comparison between LA and OA regarding hospital stay and VAS for post-operative pain assessment after 12 and 24 hours and cosmetic outcome.

		Laparoscopic group No. = 30	Open group No. = 30	Test value‡	P-value	Sig.
Hospital stay	Median (IQR)	3.5 (2 – 4)	4 (3 – 7)	-1.837	0.066	NS
	Range	1 – 9	2 – 15			
Pain score after 12 hrs.	Median (IQR)	5 (5 – 6)	7 (6 – 8)	-5.332	0.000	HS
	Range	4 – 7	5 – 9			
Pain score after 24 hrs.	Median (IQR)	3 (3 – 4)	4 (3 – 5)	-3.146	0.002	HS
	Range	2 – 5	2 – 6			
VAS for cosmetic outcome	Median (IQR)	7 (6 − 8)	6 (4 − 7)	-3.155≠	0.002	HS
	Range	3 – 9	2 – 9			
	VAS 0-3 (Bad)	1 (3.3%)	7 (23.3%)	7.344*	0.025	S
	VAS 4-6 (Good)	7 (23.3%)	10 (33.3%)			
	VAS 7-10 (Excellent)	22 (73.3%)	13 (43.3%)			

DISCUSSION:

The decision to perform LA in CA has always been controversial due to the challenging nature of performing minimally invasive surgery in an area of distorted anatomy and severe inflammation. Dissecting and visualizing the appendix clearly while also preventing the spread of infection from the inflamed appendix to the surrounding viscera is demanding [(9)].

In recent years, as laparoscopic surgery became more mainstream and widely practiced, various authors published and reported favorable outcomes when LA is utilized in the setting of CA [(10)].

This study included a total of 60 patients with CA. They were divided into two equal groups where 30 patients underwent conventional OA and 30 patients underwent LA. The age of included patients ranged from 12-64 years with a mean ± SD of 30.70 ± 13.74. Most of the patients (28.3%) were in the age group between 10-20 years. These results were comparable to a study done by Jailani et al. where the mean age (±SD) for LA and OA were 32 (±15) and 30 (±14) years respectively and also comparable to a multicenter prospective observational study by Yeh et al. where median age was 37 (27–52) years.[(11,12)]

The study comprised 35 males (58.3%) and 25 females (41.7%). This co-relates with most of the literature noting slight male predominance. Addiss et al. stated that men are at greater risk than women with a case ratio in most series of 1.4:1 and that the lifetime risk of appendicitis has been estimated at 8.6% in men and 6.7% in women [(13)].

Leukocytosis was found in 52 patients (86.7%) where normal WBC was found in 8 patients (13.3%). Peksöz et al. in their study stated that the likelihood of AA increases as the WBC value increases, if the values are higher the risk of CA becomes higher and that it can be said that WBC values play an important role in determining the severity of AA.[(14)] As in our study, Sack et al. didn't demonstrate an association between a certain value of leukocytosis and CA patients.[(15)]

A systematic literature search conducted by Quah et al. included twenty-five studies, reported similar operative duration findings in both groups being also slightly higher in the LA group (OA group 74.6 min ± 19.6 and LA group 82.2 min ± 24.7, p = 0.19).[(16)]Possible explanations for increased operative time in our study in general and in the LA group in specific, in our study are the conversion to open surgery via midline incision in 3 patients (10%), performing additional procedures in 4 patients in the LA

group and also operating through a midline incision in 3 patients (10%) in the OA group.

Duration of hospitalization is an important factor that directly impacts the patients' finances and overall wellbeing. However, the association of LA with a shorter duration of hospitalization remains debatable. Our results were comparable to a study by Nazir et al.who reported insignificant difference between the two groups with a mean length of hospitalization of 4.38 ± 1.09 days in laparoscopic surgery and 4.18 ± 0.77 days in the open surgery group (p=0.23).[17]

Conversion to open surgery was done in 3 patients in the LA group (10%)**.** The first patient had extensive generalized peritonitis with amulgamated bowel loops causing technical difficulty in proceeding with laparoscopic approach. The 2nd patient had an appendicular mass involving the whole ceacum with no planes for safe dissection while the 3rd patient had an appendicular abscess with gangrenous appendix and ceacum, so right hemicolectomy was indicated in the latter 2 patients and was not technically feasible via laparoscopic approach.

Similar to our results, a systemic review and meta-analysis by Athanasiou et al. in reported that laparoscopic conversion rates to open surgery varied from 20 to 45% in studies reporting data on patients operated on before 2000, while studies reporting on patients undergoing surgery in the third millennium reported conversion rates of 0 to 18%, with the exception of one study that reported a high conversion rate of 41% with no reported laparoscopic surgical experience.[10] Our results were better than a study by Sekine et al. where 14 patients diagnosed with appendiceal abscess underwent emergency LA and conversion was done in 6 patients (43%) due to dense adhesions.[18]

Regarding some surgical details, using an omental patch application on the appendicular stump technique was used in 13 patients (21.7%) in our study, 11 patients in the LA group (36.7%) and 2 patients in the OA group (6.7%) with a high statistical significance (P-value=0.005).

Right hemicolectomy was done in 4 patients in our study (6.7%), 2 patients in the OA group (6.7%) and 2 patients in the LA group (6.7%). In the OA group one patient had a perforated gangrenous ceacum and the other had a perforated ceacum with related posterior abdominal wall abscess. In the LA group, right hemicolectomy was done after conversion to open surgery in both patients. One patient had a gangrenous ceacum, while the other had an inflammatory phlegmon involving a related ceacal mass

A midline incision was used in 7 patients in our study (11.7%), 4 patients in the OA group (13.3%) and 3 patients in the LA group (10%) after conversion to open surgery.

Additional procedures were done in 4 patients in our study (6.7%), all of them were in the LA group (13.3%) with statistical significance (P-value=0.038). Laparoscopic cholecystectomy was done for two patients who had symptomatic chronic calcular cholecystitis, laparoscopic excision of a large right ovarian cyst in one patient and laparoscopic excision of a left ovarian chocolate cyst in another patient.

Peri-operative complication occurred in one patient only (1.7%) in the present study. This occurred in a 21 years old female patient in the LA group (3.3%) (P-value=0.313). The patient who presented with CA giving a vague history of menstrual irregularities and menorrhagia, was discovered to have severe anemia (hemoglobin 6.7 gm/dl) on presentation. This was managed pre-operatively by repeated blood transfusion of 3 units of packed RBCs.

Intraoperative complications occurred in 4 patients (6.7%) in the study. All of these complications occurred in the OA group (13.3%) with statistical significance (P value = 0.038). These complications were in the form of a cecal serosal tear in one patient, an iatrogenic injury to the terminal ileum in another patient, bleeding from iatrogenic injury to a mature Graafian follicle in a female patient and a case of stapler misfire (malfunction) in a patient during performing a stapled ilio-transverse anastomosis. Both patients with iatrogenic injuries to the colon and small intestine were managed by 1ry repair using vicryl 3-0 sutures. The bleeding Graafian follicle was controlled with under-running vicryl sutures. Stapler misfire was managed by revision of the anastomosis using hand-sewn technique.

Post-operative/delayed complications occurred in 18 patients (30%) in the study. The most occurring post-operative/ delayed complication was fever, which occurred in 10 patients (16.7%), 7 in the OA group (23.3%) and 3 patients in the LA group(10%). All patients in the OA group had fever between postoperative days 1-3. One patient in the LA group had fever on post-operative day 1 while the other two patients developed fever after being discharged from the hospital and the latter were diagnosed as having an IAA.

Nakhamiyayev et al. reported 6 patients (2.27%) out of 264 patients with unexplained fever in his retrospective study, 2 in the LA group and 4 in the OA group but he only had CA in 25 patients(16.1%) in the LA group and 23patients (21.1%) in the OA group.[(19)]In a study by Lanitis et al. involving 135 patients he reported incidence of post-operative fever in 23.9% of OA group (n=57) and 31.4% of LA group (n=78) (P-value= 0.242). [(20)]

Superficial SSI occurred in 4 patients in our study (6.7%) all of them were in the OA group (13.3%) (P-value= 0.038). They were managed by repeated dressings, post hospital discharge antibiotics according to culture and sensitivity results and frequent follow up visits in the outpatient clinic.

Similar to our results, an analytical study by Tashiro et al. including patients with CA, 28793 patients treated with LA and 30782 patients underwent OA, 607 patients in the LA group (2.11%) and 1233 patients in the OA group (4.01%) had wound infections which was statistically significant less in LA group (P-value =0.001). [(21)]

Increased drain amount occurred in one patient in the study in the LA group (3.3%) and prolonged drainage in one patient in the LA group (3.3%) with no statistical significance. In the latter patient, she was discharged with the suction drain until it was removed on day 13 postoperative.

Post-operative ileus occurred in 2 patients in our study (3.3%), both in the OA group (6.7%). The first patient developed ileus on day 3 post-operative and was managed successfully by conservative measures in the form of NPO regimen. The other patient was discovered to being hypokalemic and despite correction of his serum potassium level he still had repeated vomiting, absolute constipation and abdominal distention. Abdominal radiograph revealed multiple air-fluid levels and was further diagnosed as having an intestinal obstruction, the only patient in our study to develop this complication.

Hospital readmission took place in only one patient in the study (1.7%) in the LA group (3.3%) with no statistical significance (P-value=0.313). The patient was admitted with fever and acute abdomen on postoperative day 8 and needed re-operation. In a retrospective cohort study involving 14798 patients with CA, Yamada et al. reported 344 patients (2.32 %) who needed readmission [(22)].Our results are better than Thomson et al. who reported 7 cases (6.1%) of hospital re-admission out of 114 patients with CA, 3 cases in the LA group and 4

cases in the OA group with no significance (P-value=0.77). Of the seven patients that required readmission, three underwent re-operation and the other four were treated conservatively for wound sepsis.[23]

Two patients in our study (3.3%) needed re-operation, one patient in the LA group (3.3%) and the other in the OA group (3.3%) with no statistical significance (P-value =1.000). The patient in the OA group had a subhepatic appendicular abscess with a perforated appendix and developed intestinal obstruction on post-operative day 5. His abdominal radiograph showed multiple air-fluid levels. A pelvi-abdominal CT was done and showed dilated bowel loops with possible ischemic changes. He underwent abdominal exploration which revealed adhesive intestinal obstruction due to an obstructing band and an ileostomy was done. Closure of his ileostomy was done 2 months later. The other patient in the LA group presented with an appendicular mass and pelvic collection in her primary surgery. Post hospital discharge she was re-admitted after developing fever and acute abdomen on day 8. On day 9 she underwent laparoscopic exploration which was converted to lower midline laparotomy which revealed an IAA which was drained with peritoneal lavage and drains insertion.

Organ space infection (OSI**)** occurred in 2 patients in our study (3.3%) both of them were in the LA group (6.7%) with no statistical significance (P-value=0.150). The first patient was managed by ultrasound (US) guided aspiration and pig-tail insertion with extended antibiotic coverage according to culture and sensitivity test until US confirmed the resolution of the collection. The second patient is the previously mentioned re-admitted patient, who developed a recurrent IAA related to the anterior abdominal wall and extending to Douglas pouch on day 15 after 1ry operation. The pig-tail was left in place with serial follow up pelvi-abdominal US before it slipped on day 10 after the 2nd operation with complete resolution of the abscess.

Our results are better than those of a single-center randomized controlled trial performed in the Nagoya Daini Red Cross Hospital by Taguchi et al. where 81 patients with CA were enrolled and randomly assigned with a 1:1 allocation ratio (42, LA; 39, OA). [24]They reported the occurance of OSI in 8 patients (19.0 %) in LA group and 7 patients (17.9 %) in the OA group with no statistical significance (P-value =1.000).

In a retrospective study by Mulita et al. involving 1809 appendectomies, of which 415 (22.9%) were performed for CA, IAA developed in 14 out of 198 patients (7.07%) who underwent OA for CA, while abscess formation was recorded in 11 out of 212 patients (5.1%) with CA of the LA group with no significant difference ($p > 0.05$) in the rate of abscess formation between two groups with complicated disease which is comparable to our results in the LA group[25]

Regarding post-operative pain, assessment was done 12 hours and 24 hours after the surgical intervention using a VAS. The results were highly significant in favor of LA group both after 12 & 24 hours with P-values 0.000 and 0.002 respectively. These results are similar to results reported by Goudar et al. who qualitatively assessed the post-operative pain by means of a VAS on the first three consecutive days and this was quantitatively assessed by the daily requirement of analgesics and the pain was significantly less in the LA group in (P-value= 0.0123).

Regarding the assessment of the aesthetic results as perceived by patients after appendicectomy, VAS for the scar assessment was done 2 weeks post hospital discharge. A score between 0-3 was considered as bad, 4-6 as good and 7-10 was excellent. The results were in favor of laparoscopic approach with a high statistical significance (P-value =0.002).Similar to our

study, Kapsichke et al. in a recent study reporting on the long-term cosmetic outcomes following OA and LA in children and adolescents, showed that following their operation, patients were significantly more likely to recommend LA to their family and friends compared with OA.[26]

Conclusion:

The study findings confirmed previous studies' results and clearly demonstrates superiority of LA in CA regarding decreased incidence of postoperative SSI with comparable results regarding operative time, length of hospital stay, rates of hospital readmission and the need of re-operation. In conclusion, our study, although small in number, demonstrates that LA can be safely adopted in CA and can be performed safely with a low incidence of infectious complications. It may also have potentially more prominent clinical advantages over conventional surgery.

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Conflicts of interest:

There are no conflicts of interest.

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دراسة مقارنة بين استئصال الزائدة الدودية التي بها مضاعفات باستخدام المنظار الجراحي والجراحة التقليدية

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الخلفية: استئصال الزائدة الدودية بالمنظار هو الأسلوب المفضل في التهاب الزائدة الدودية غير المصحوب بمضاعفات. ومع ذلك ، في المرضى الذين يعانون من التهاب الزائدة الدودية المعقد، لا يزال النهج الأفضل غير واضح.

هدف العمل: دراسة عشوائية مستقبلية لمقارنة نتائج عملية استئصال الزائدة الدودية بالمنظار واستئصال الزائدة الدودية جراحياً في حالات التهاب الزائدة الدودية التى بها مضاعفات فيما يتعلق بفعاليتها وسلامتها ومضاعفات ما بعد الجراحة.

المرضى والطرق: تم حجز ٦٠ مريضًا بتشخيص التهاب الزائدة الدودية التى بها مضاعفات (المعقدة)، تم تقسيمهم الى مجموعتين، مجموعة استئصال الزائدة الدودية بالمنظار ومجموعة استئصال الزائدة الدودية جراحياً وتضم كل مجموعة ٣٠ مريضاً. تم متابعة المرضى لوجود اى مضاعفات ما بعد العملية وتم متابعة المرضى بالعيادات الخارجية لمدة ١٢ شهر.

النتائج: فى مجموعة استئصال الزائدة الدودية بالمنظار تبين وجود معدل منخفض من حدوث عدوى بالجرح ووجود نتائج متقاربة من حيث وقت العملية، مدة الاقامة بالمستشفى، معدلات إعادة الحجز بالمستشفى والاحتياج الى إعادة التدخل الجراحى. برهن استئصال الزائدة الدودية بالمنظار على وجود مميزات جديرة بالإعتبار تتخطى استئصال الزائدة الدودية جراحياً في حالات إلتهاب الزائدة الدودية التي بها مضاعفات (المعقدة) مثل انخفاض الاحساس بالألم ما بعد العملية وازدياد رضاء المريض عن الشكل الجمالى.

الخلاصة: استئصال الزائدة الدودية بالمنظار من الممكن تبنيه بدون خطورة فى حالات إلتهاب الزائدة الدودية التي بها إلتهابات (المعقد) و من الممكن ممارسته بأمان مع معدل حدوث مضاعفات تلوثية قليل.