Assessment of the outcome of Laparscopic appendicectomy

Haroun Abd Al Kareem Allam, Magdy Salah El-Din Hussain and Mostafa Abd El Megeed El Fiky

Department of general surgery, Faculty of medicine for boys Al Azhar university, Egypt
drsaharkhattab@hotmail.com

Abstract: Acute appendicitis is one of the most frequent conditions seen in a surgical department; urgent appendectomy is considered the treatment of choice because of the low incidence of major complications and the relative rapidity of operation and hospital stay. Because of lack of good evidence supporting laparoscopic approach for complicated appendicitis, we carried out this study to evaluate efficacy of laparoscopic appendectomy (LA) in management of patients with complicated as well as uncomplicated appendicitis. Our study demonstrated that complicated appendicitis cases had longer operative time, increased number of analgesia, longer time for drainage and intravenous antibiotics, longer hospital stay and delayed return to normal activities when compared uncomplicated cases. Our study also showed that doing laparoscopic appendectomy in children and obese cases is as safe as in adults and non obese respectively with no increase in postoperative complications in terms of wound infection, Intra-abdominal abscess, atelectasis, paralytic ileus, hemoperitoneum and incisional hernia. Our study also demonstrated that laparoscopic appendectomy can be performed safely in acute appendicitis with or without complication with a low incidence of infectious complications and offering patients faster recovery and return to normal activity than open appendectomy on the expense of longer operative time. In conclusion, our study demonstrated that treatment of complicated appendicitis laparoscopically is feasible, safe and can offer a less post-operative pain, less usage of post operative analgesics and antibiotics, a rapid recovery and return to normal activities as well as better cosmoses on the expense of longer operating time than OA.
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1. Introduction

Approximately 6% of population develops acute appendicitis in their life time, with highest incidence between ages of 10 and 30 years. Traditionally acute appendicitis is diagnosed clinically and treated with surgical removal of appendix (**Shuja et al, 2017**).

Acute Appendicitis is acute inflammation of the appendix, usually resulting from bacterial infection, which may be precipitated by obstruction of the lumen by a fecolith; variable symptoms often consisting of peri-umbilical colicky pain and vomiting may be followed by fever, leucocytosis, persistent pain and signs of peritoneal inflammation in the right lower quadrant of the abdomen **(Singer, 2016).**

Complicated appendicitis is defined as acute inflammation of appendix associated with perforation or with purulent peritoneal collection of abscess formation and generalized peritonitis. It comprises 20% to 30% of all cases of acute appendicitis. It has been associated with a significant risk of post-operative septic complications including wound infections and intra-abdominal abscess formation **(Schlottmann, 2016)**.

Appendectomy is the most common surgical procedure performed in surgical emergency. The advent of minimal invasive surgery has massively influenced the field of surgery. In 1894 Charles MacBurney first performed open appendectomy, for a century open appendectomy was gold standard treatment of acute appendicitis **(Tiwari, 2011).**

Appendectomy outcomes differ considerably secondary to patient illness severity and diagnosis of either complicated or uncomplicated appendicitis. Despite conflicting results several studies have demonstrated the superiority of laparoscopic approach in uncomplicated appendicitis (**Yau, 2007).**

Laparoscopic appendectomy (LA) has the advantage of providing better access and good visualization of the peritoneal cavity through small incisions, as compared to open appendectomy (OA). Laparoscopic approach has the advantage of better results in obese patients, shorter hospital stay, less post-operative pain and better aesthetic results. This technique is associated with higher incidence of intra-abdominal abscess, higher cost, the need for laparoscopic skills by surgeon and equipment available in all shifts **(Coccolini, et al, 2015)**.

Despite numerous clinical trials and meta-analyses of the data, it is still not clear whether open appendectomy (OA) or laparoscopic appendectomy (LA) is the most efficacious and effective surgical approach to acute appendicitis presenting after 48 hours with or without complication (**Irfan, 2015).**

Because of lack of good evidence supporting laparoscopic approach for complicated appendicitis, we carried out this study to evaluate efficacy of laparoscopic appendectomy (LA) in management of patients with complicated as well as uncomplicated appendicitis.

2. Subjects and Methods

Subjects

A total of one hundred and fifty patients suffering from acute appendicitis were studied. This study included 100 patients with acute appendicitis who underwent laparoscopic appendectomy (LA group). They were divided into two groups; group I (72 patients) with uncomplicated appendicitis and group II (28 patients) with complicated appendicitis (perforated or gangrenous). Patients who had LA were also classified according to age; group A: < or = 18 years (24 patients) and group B: > 18 years (76 patients). Also LA patient were classified according to BMI into obese (18 patients with BMI > 40) and non obese (72 patients with BMI < 40). The study also included another 50 patients with appendicitis who had open appendectomy (OA group).

Methods:

Three ports laparoscopic appendicecctomy

3. Results

Details of the clinical and biochemical features of the study population are illustrated in Tables (1 - 11).

Table (1): Comparison between Group I and Group II of LA patients as regards Laboratory results

Laboratory results		Group I No. = 72	Group II No. = 28	Test value	P-value	Sig.
Leukocyte (x 10^3/ dl)	Mean ± SD Range	11.56 ± 1. 08 10.5 – 18	21.39 ± 3. 45 16.5 – 30	-21.742•	0.000	HS
Neutrophil (x 10^2/ dl)	Mean ± SD Range	79.57 ± 2.48 75 – 85	82.43 ± 1.93 78 – 85	-5.476•	0.000	HS
Urine analysis	Median (IQR) Range	12 (8 – 25) 7 – 25	32 (15 – 35) 4 – 55	-1.865‡	0.062	NS

Table (2): Comparison between Group I and Group II of LA patients as regards Ultrasound results

Ultrasound	Group I		Group II		Test value	P-value	Sig.
	No.	%	No.	%			
Blind ended ioop	11	15.3%	0	0.0%	44.610	0.000	HS
Distended loop	0	0.0%	2	7.1%			
Free (only inflamed)	44	61.1%	4	14.3%			
Mass. Rt. Iliac fossa	0	0.0%	2	7.1%			
Mild pelvic collection	0	0.0%	1	3.6%			
Minimal pelvic collection	12	16.7%	15	53.6%			
Minimal rt. Iliac fossa f collection	0	0.0%	2	7.1%			
Picture of rupture appendix	0	0.0%	1	3.6%			
Rt. Iliac fossa collection	5	6.9%	1	3.6%			

Table (3): Comparison between Group I and Group II of LA patients as regards Operative details

Operative details		Group I No. = 72	Group II No. = 28	Test value	P-value	Sig.
Operative time (min)	Mean ± SD Range	33.96 ± 4.89 25 – 45	73.93 ± 10.83 45 – 90	-25.472•	0.000	HS
Mean blood loss (ml)	Mild Minimal No	0 (0.0%) 10 (13.9%) 62 (86.1%)	2 (7.1%) 12 (42.9%) 14 (50.0%)	16.292*	0.000	HS

Table (4): Comparison between Group I and Group II of LA patients as regards Postoperative details

Postoperative details		Group I No. = 72	Group II No. = 28	Test value	P-value	Sig.
Number of analgesics	Mean ± SD Range	2.17 ± 0.73 2 – 6	4.36 ± 0.78 4 – 6	-13.197•	0.000	HS
Duration of intravenous antibiotics (days)	Mean ± SD Range	1.06 ± 0.33 1 – 3	1.54 ± 1.17 1 – 4	-3.191•	0.002	HS
Duration of drainage (days)	Mean ± SD Range	2.50 ± 0.71 2 – 3	4.60 ± 0.55 4 – 5	-4.305•	0.008	HS
Hospital stay (day)	Median (IQR) Range	1 (1 – 1) 1 – 1	3 (3 – 4) 2 – 5	-9.789‡	0.000	HS
Return to normal activities (days)	Mean ± SD Range	7 ± 0 7 – 7	11.39 ± 3.61 7 – 20	-10.397•	0.000	HS

Table (5): Comparison between Group I and Group II of LA patients as regards Postoperative complications

Postoperative complications		Group I		Group II		Test value	P-value	Sig.
		No.	%	No.	%			
Wound infection	No	72	100.0%	26	92.9%	5.248*	0.022	S
	Yes	0	0.0%	2	7.1%			
Intra- abdominal abscess	No	72	100.0%	25	89.3%	7.953	0.005	HS
	Yes	0	0.0%	3	10.7%			
Atelectasis	No	72	100.0%	26	92.9%	5.248	0.022	S
	Yes	0	0.0%	2	7.1%			
Paralytic ileus	No	71	98.6%	26	92.9%	2.294	0.130	NS
	Yes	1	1.4%	2	7.1%			
Hemoperitoneum	No	71	98.6%	28	100.0%	0.393	0.531	NS
	Yes	1	1.4%	0	0.0%			
Incisional hernia	No	72	100.0%	26	92.9%	5.248	0.022	S
	Yes	0	0.0%	2	7.1%			

Aiming to study the benefit of doing laparoscopic appendectomy to children, patients were classified according to age to: group A < or = 18 years (24 patients) and group B > 18 years (76 patients). Age 18 is chosen for the classification as The United Nations Convension on the Rights of the Child defines child as "A human being below the age of 18" (Convension on the Rights of the Child, 2010).

Table (6): Comparison between Group A and Group B of LA patients as regards Laboratory results, operative and postoperative details

		Age < 18	Age > 18	Test value	P-value	Sig.
		No. = 24	No. = 76			
Neutrophil (x 10^2/ dl)	Mean ± SD	80.46 ± 2.30	80.34 ± 2.78	-0.185•	0.853	NS
	Range	76 – 85	75 – 85			
Leukocyte (x 10^3/ dl)	Mean ± SD	13.85 ± 4.70	14.45 ± 4.96	0.523•	0.602	NS
	Range	10.5 – 25	10.5 – 30			
Urine analysis	Median (IQR)	7.5 (7 – 8)	25 (12.5 – 33.5)	-1.838‡	0.066	NS
	Range	7 – 8	4 – 55			
Operative time (min)	Mean ± SD	44.17 ± 19.54	45.46 ± 19.41	0.284•	0.777	NS
	Range	25 – 85	25 – 90			
Mean blood loss (ml)	Mild	0 (0.0%)	2 (2.6%)	0.765*	0.682	NS
	Minimal	6 (25.0%)	16 (21.1%)			
	No	18 (75.0%)	58 (76.3%)			
Appendix	Gangrenous	3 (12.5%)	9 (11.8%)	0.288*	0.866	NS
	Inflammed	18 (75.0%)	54 (71.1%)			
	Perforated	3 (12.5%)	13 (17.1%)			
Number of analgesics	Mean ± SD	2.75 ± 1.29	2.79 ± 1.23	0.136•	0.892	NS
	Range	2 – 6	2 – 6			
Duration of intravenous antibiotics (days)	Mean ± SD	1.21 ± 0.72	1.18 ± 0.71	-0.145•	0.885	NS
	Range	1 – 4	1 – 4			
Duration of drainage (days)	Mean ± SD	3.50 ± 2.12	4.20 ± 0.84	0.692•	0.520	NS
	Range	2 – 5	3 – 5			
Hospital stay (day)	Median (IQR)	1 (1 – 1.5)	1 (1 – 2)	-0.322‡	0.748	NS
	Range	1 – 5	1 – 5			
Return to normal activities (days)	Mean ± SD	8.21 ± 2.65	8.24 ± 2.78	0.044•	0.965	NS
	Range	7 – 14	7 – 20			

Table (7): Comparison between Group A and Group B of LA patients as regards Ultrasound findings and Postoperative complications

		Age < 18		Age > 18		Test value*	P-value	Sig.
		No.	%	No.	%			
Wound infection	No	23	95.8%	75	98.7%	0.756	0.384	NS
	Yes	1	4.2%	1	1.3%			
Intraabdominal abscess	No	24	100.0%	73	96.1%	0.977	0.323	NS
	Yes	0	0.0%	3	3.9%			
Atelectasis	No	24	100.0%	74	97.4%	0.644	0.422	NS
	Yes	0	0.0%	2	2.6%			
Paralytic ileus	No	24	100.0%	73	96.1%	0.977	0.323	NS
	Yes	0	0.0%	3	3.9%			
Hemoperitoneum	No	23	95.8%	76	100.0%	3.199	0.074	NS
	Yes	1	4.2%	0	0.0%			
Incisional	No	23	95.8%	75	98.7%	0.756	0.384	NS

		Age < 18		Age > 18		Test value*	P-value	Sig.
		No.	%	No.	%			
hernia	Yes	1	4.2%	1	1.3%			
Ultrasound	Blind ended ioop	3	12.5%	8	10.5%	7.832	0.551	NS
	Distended loop	0	0.0%	2	2.6%			
	Free	12	50.0%	36	47.4%			
	Mass. Rt. Iliac fossa	0	0.0%	1	1.3%			
	Mass. Rt. Iliac fossa collection	0	0.0%	1	1.3%			
	Mild pelvic collection	0	0.0%	1	1.3%			
	Minimal pelvic collection	8	33.3%	19	25.0%			
	Minimal rt. Iliac fossa f collection	0	0.0%	2	2.6%			
	Picture of rupture appendix	1	4.2%	0	0.0%			
	Rt. Iliac fossa collection	0	0.0%	6	7.9%			

Aiming to study the benefit of doing laparoscopic appendectomy to obese patients, patients were divided into two groups, non obese with body mass index < or = 40 (82 patients) and obese (18 patients) with body mass index > 40.

Table (8): Comparison between Non Obese and Obese LA patients as regards Operative and Postoperative details

		Non Obese	Obese	Test value	P-value	Sig.
		No. = 82	No. = 18			
Operative time (min)	Mean ± SD	45.73 ± 19.49	42.50 ± 19.04	-0.640•	0.524	NS
	Range	25 – 90	25 – 90			
Mean blood loss (ml)	mild	1 (1.2%)	1 (5.6%)	1.972*	0.373	NS
	Minimal	17 (20.7%)	5 (27.8%)			
	No	64 (78.0%)	12 (66.7%)			
Appendix	gangrenous	11 (13.4%)	1 (5.6%)	0.868*	0.648	NS
	Inflammed	58 (70.7%)	14 (77.8%)			
	perforated	13 (15.9%)	3 (16.7%)			
Number of analgesics	Mean ± SD	2.83 ± 1.26	2.56 ± 1.15	-0.850•	0.397	NS
	Range	2 – 6	2 – 6			
Duration of intravenous antibiotics (days)	Mean ± SD	1.20 ± 0.71	1.17 ± 0.71	-0.154•	0.878	NS
	Range	1 – 4	1 – 4			
Duration of drainage (days)	Mean ± SD	4.00 ± 1.26	4.00 ± 0.00	0.000•	1.000	NS
	Range	2 – 5	4 – 4			
Hospital stay (day)	Median (IQR)	1.00 (1 – 2)	1.00 (1 – 1)	-0.738ǂ	0.461	NS
	Range	1 – 5	1 – 5			
Return to normal activities (days)	Mean ± SD	8.38 ± 2.91	7.56 ± 1.65	-1.156•	0.250	NS
	Range	7 – 20	7 – 14			

Table (9): Comparison between Non Obese and Obese LA patients as regards Ultrasound and Postoperative Complications

		Non Obese		Obese		Test value*	P-value	Sig.
		No.	%	No.	%			
Wound infection	No	80	97.6%	18	100.0%	0.448	0.503	NS
	Yes	2	2.4%	0	0.0%			
Pelvic abscess	No	79	96.3%	18	100.0%	0.679	0.410	NS
	Yes	3	3.7%	0	0.0%			
Atelectasis	No	81	98.8%	17	94.4%	1.416	0.234	NS
	Yes	1	1.2%	1	5.6%			
Paralytic ileus	No	79	96.3%	18	100.0%	0.679	0.410	NS
	Yes	3	3.7%	0	0.0%			
Hemoperitoneum	No	81	98.8%	18	100.0%	0.222	0.638	NS
	Yes	1	1.2%	0	0.0%			
Incisional hernia	No	80	97.6%	18	100.0%	0.448	0.503	NS
	Yes	2	2.4%	0	0.0%			
Ultrasound	Blind ended ioop	8	9.8%	3	16.7%	6.803	0.658	NS
	Distended loop	2	2.4%	0	0.0%			
	Free	40	48.8%	8	44.4%			
	Mass. Rt. Iliac fossa	0	0.0%	1	5.6%			
	Mass. Rt. Iliac fossa collection	1	1.2%	0	0.0%			
	Mild pelvic collection	1	1.2%	0	0.0%			
	Minimal pelvic collection	22	26.8%	5	27.8%			
	Minimal rt. Iliac fossa f collection	2	2.4%	0	0.0%			
	Picture of rupture appendix	1	1.2%	0	0.0%			
	Rt. Iliac fossa collection	5	6.1%	1	5.6%			

In order to study the outcome of laparoscopic in comparison to open appendectomy, 50 patients who had open surgery were also included in the study.

Table (10): Comparison between LA and OA patients as regards demographic data, laboratory results, operative and postoperative details

All Demographic data	Group I (LA) No. = 100	Group II (OA) No. = 50	Test value	P-value	Sig.
Demographic data					
Male	64 (64.0%)	27 (54.0%)	1.397	0.237	NS
Female	36 (36.0%)	23 (46.0%)			
Point of pain					
lower abdomen	1 (1.0%)	0 (0.0%)	7.530	0.057	NS
MC.B	68 (68.0%)	32 (64.0%)			
Pelvic	22 (22.0%)	18 (36.0%)			
Rt. iliac fossa	9 (9.0%)	0 (0.0%)			
Laboratory results					
leucocytic count (x 10^3/ dl)	14.31 ± 4.88	15.25 ± 5.45	-1.069	0.287	NS
Operative details					
operative time	45.15 ± 19.35	55 ± 22.15	-2.799	0.006	HS
Blood loss					
No	76 (76.0%)	16 (32.0%)	2.472	0.291	NS
Mild	2 (2.0%)	0 (0.0%)			
Minimal	22 (22.0%)	9 (18.0%)			
Postoperative details					
Number of analgesics	2.78 ± 1.24	8 ± 3.44	-13.551	0.000	HS
Duration of intravenous antibiotics (days)	1.19 ± 0.71	4 ± 1.28	-17.298	0.000	HS
Duration of drainage (days)	4 ± 1.15	3 ± 1.17	4.992	0.000	HS
Hospital stay (day)	1 (1 – 2)	4.5 (2 – 6)	-11.164	0.000	HS
Return to normal activities (days)	8.23 ± 2.74	17 ± 3.5	-16.805	0.000	HS
Postoperative complications					
Wound infection	2 (2.0%)	2 (4.0%)	0.514	0.473	NS
Paralytic ileus	3 (3.0%)	1 (2.0%)	0.128	0.721	NS
Hemoperitoneum	1 (1.0%)	0 (0.0%)	0.503	0.478	NS
Incisional hernia	2 (2.0%)	2 (4.0%)	0.514	0.473	NS

Table (11): Comparison between LA and OA Complicated patients as regards demographic data, laboratory results, operative and postoperative details

Complicated	Group I (LA) No. = 18	Group II (OA) No. = 28	Test value	P-value	Sig.
Demographic data					
Male	9 (32.1%)	9 (50.0%)	1.467	0.226	NS
Female	19 (67.9%)	9 (50.0%)			
Point of pain					
lower abdomen	1 (3.6%)	0 (0.0%)	20.810	0.000	HS
MC.B	9 (32.1%)	0 (0.0%)			
Pelvic	9 (32.1%)	18 (100.0%)			
Rt. iliac fossa	9 (32.1%)	0 (0.0%)			
Laboratory results					
leucocytic count (x 10^3/ dl)	21.39 ± 3.45	16.5 ± 1.31	5.735	0.000	HS
Operative details					
Operative time	73.93 ± 10.83	65 ± 10.15	2.796	0.007	HS
Blood loss					
No	14 (50.0%)	0 (0.0%)	15.771	0.000	HS
Mild	2 (7.1%)	0 (0.0%)			
Minimal	12 (42.9%)	18 (100.0%)			
Postoperative details					
Number of analgesics	4.36 ± 0.78	10 ± 2.58	-10.878	0.000	HS
Duration of intravenous antibiotics (days)	1.54 ± 1.17	5 ± 1.52	-8.701	0.000	HS
Duration of drainage (days)	4.60 ± 0.55	5 ± 1.23	-1.509	0.139	NS
Hospital stay (day)	3 (3 – 4)	6 (2 – 8)	-5.583	0.000	HS
Return to normal activities (days)	11.39 ± 3.61	20 ± 4.88	-12.068	0.000	HS
Postoperative complications					
Wound infection	2 (7.1%)	1 (5.6%)	0.045	0.832	NS
Paralytic ileus	2 (7.1%)	1 (5.6%)	0.045	0.832	NS
Hemoperitoneum	0 (0.0%)	0 (0.0%)	NA	NA	NA
Incisional hernia	2 (7.1%)	1 (5.6%)	0.045	0.832	NS

Our study demonstrated that complicated appendicitis cases had longer operative time, increased number of analgesia, longer time for drainage and intravenous antibiotics, longer hospital stay and delayed return to normal activities when compared uncomplicated cases (Tables 1- 5).

Our study also showed that doing laparoscopic appendectomy in children and obese cases is as safe as in adults and non obese respectively with no increase in postoperative complications in terms of wound infection, Intra-abdominal abscess, atelectasis, paralytic ileus, hemoperitoneum and incisional hernia (Tables 6- 9).

Our study also demonstrated that laparoscopic appendectomy can be performed safely in acute appendicitis with or without complication with a low incidence of infectious complications and offering patients faster recovery and return to normal activity than open appendectomy on the expense of longer operative time (Tables 10- 11).

4. Discussion

Acute appendicitis is one of the most frequent conditions seen in a surgical department; urgent appendectomy is considered the treatment of choice because of the low incidence of major complications and the relative rapidity of operation and hospital stay. Nevertheless surgical treatment exposes the patient to risks due to general anaesthesia and other complications such as surgical site infection, adhesions and intestinal obstruction, incisional hernia, infertility in female and pneumonia **(Tugnoli et al., 2011).**

There are still controversial issues in the treatment of acute appendicitis such as comparison between laparoscopic and open appendectomy and the correct approach in special categories of patients.

The number of laparoscopic appendectomies (LA) has progressively increased since it has been demonstrated to be a safe procedure, with excellent cosmetic results; furthermore, LA allows a shorter hospitalization, a quicker and less painful postoperative recovery **(Rufffol et al., 2013).**

But is laparoscopic surgery the best choice for appendectomy? Which are the correct surgical indications? What are the results from complicated vs uncomplicated appendicitis, or the comparison between LA vs classic open appendectomy (OA)? Are there selected groups of patients in which one of these approaches should be preferred?

Also, there is a debated issue regarding septic postoperative complications (e.g., intra-abdominal abscess) following LA, especially in cases with complicated appendicitis. Although some studies have concluded that LA is a safe and effective treatment for complicated acute appendicitis, undesirable short-term results including prolonged operation time and postoperative stay, increased rate of conversion, and greater complications due to infection have been reported when compared to uncomplicated appendicitis. Thus, some surgeons are hesitant to perform LA in those patients in whom they suspect complicated appendicitis **(Yeh, 2008).** Therefore, the aim of this study was to investigate the feasibility of LA in cases of complicated acute appendicitis.

To assess the value of laparoscopic appendectomy in uncomplicated and complicated appendicitis the operative details were compared. Operative time, mean blood loss show highly significant difference between the two groups.

LA for patients with complicated appendicitis took longer time to perform ($p = 0.000$) with more blood loss ($p=0.000$), more use of analgesics ($p =0.000$), longer duration of antibiotic intake (p-0.002), longer duration of abdominal drainage ($p = 0.008$), longer hospital stay ($p =0.000$), delayed return to normal activities ($p=0.000$) than LA for uncomplicated appendicitis.

On comparing the post operative details as number of analgesics, duration of intravenous antibiotics (days), duration of drainage (days) and return to normal activities (days), they were all comparable between the two groups. Complicated appendicitis patients had higher incidence of wound infection ($p = 0.003$), intra-abdominal abscess ($p=0.005$), atelectasis ($p=0.022$) and incisional hernia $p=0.022$)). Three patients in complicated group developed intra-abdominal abscess treated successfully with sonographic guided percutaneous drainage.

Our results goes with **Irfan and his colleagues (2015**) who had a study on a total of 452 patients who were operated with LA, 362 patients with uncomplicated appendix and 90 complicated appendicitis cases. In their study the post operative complications were comparable to ours. In our work the most common complication that occured for patients with complicated appendicitis was intraabdominal abcess followed by wound infection, paralytic ilieus and incisional hernia. **Krisher and his co-workers (2001)** stated that wound infection followed by intaabdominal abcess, incisional hernia and ilieus were the common complications to occur after performing LA in complicated appendicitis but with higher rates of intraabdominal infections

Many mechanisms have been suggested for the occurrence of intra-abdominal abscess formation after LA. In one theory, pneumoperitoneum may cause dissemination of infected material within the peritoneal cavity. Manipulation of appendix for a long

time in LA can also be another factor for the increased rate of intraabdominal infection. Carbon dioxide used for pneumoperitoneum may ease the growth of anaerobic microorganisms, **(Ferranti et al., 2012).** As the infected area has severe peritonitis, carbon dioxide insufflations promote mechanical spread of bacteria, the excessive peritoneal lavage and simple abdominal suction often lead to contamination of the abdominal cavity. (In addition, abdominal infection is often difficult to completely drain, and can easily lead to the formation of an intra-abdominal abscess **(Schlottmann et al., 2016).** Patients with obesity, leukocytosis >20, 000/mm3, perforated appendicitis and surgical time longer than 90 min have a higher chance of having a postoperative IAA. A close postoperative follow-up would be necessary in these situations in order to prevent and identify IAA after LA **(Schlottmann et al., 2017).**

Although most surgeons prefer to place a drain to collect contaminated abdominal fluid to prevent consequent abscess formation, the placement of intra-abdominal drain in complicated acute appendicitis may not present benefits and may even lengthen hospital stay. These observations suggest that there is no need of using a drain in laparoscopic appendectomy for complicated acute appendicitis **(Schlottmann et al., 2016).**

The role of laparoscopy in the management of perforated appendicitis in children continues to be controversial. Some studies have demonstrated an increased risk of intraabdominal abscess and wound infections for perforated appendicitis treated with LA, while others have demonstrated non inferiority. Aiming to study the benefit of doing laparoscopic appendectomy to children, patients were classified according to age to: group A < or = 18 years (24 patients) and group B > 18 years (76 patients) On comparing demographic data and symptoms and signs on admission between the two groups only gender was comparable (show highly significant difference) while other parameters did not differ.

When laboratory results, operative and postoperative details were compared between group A and group B, no difference was found. When ultrasound findings and postoperative complications and follow up results of group A and group B were compared, the results did not differ which means that laparoscopic appendectomy in children is as safe as that in adults.

The complication rate for both LA and OA approaches in children failed to show statistically significant differences, similar to the majority of recent studies **(Khubrani et al., 2018).** However, another report claimed that LA showed less complication rate in pediatric appendectomy **(Omer, 2006).**

In the present study, the hospital stay showed non significant difference between children and adults after LA in pediatric patients; however, additional pediatric studies have shown that LA resulted in a shorter hospital stay **(Elofsson et al., 2016 and Omer, 2006).**

The growing demand for this procedure can be satisfied without increase in cost, morbidity, or mortality. Laparoscopic appendectomy is the procedure of choice in children **(Li et al., 2017).**

Morbid obesity has become a major global health problem and as such treating common surgical problems must factor this into determining best care practices. Laparoscopic appendectomy is commonly employed as a treatment modality for acute appendicitis and offers potentially decreased morbidity and mortality. However there is still ongoing debate whether Laparoscopic appendectomy offers any benefit in morbidly obese patients **(Rodney et al., 2012).**

Aiming to study the benefit of doing laparoscopic appendectomy to obese patients, patients were divided into two groups, non obese with body mass index < or = 40 (82 patients) and obese (18 patients) with body mass index > 40.

When ultrasound findings, operative details, postoperative complications and follow up results of non obese and obese patients were compared, the results were not comparable which means that laparoscopic appendectomy in obese patients is as safe as that in non obese patients.

The laparoscopic approach has become increasingly favored over open surgical methods for its association with decreased postoperative pain, more rapid return to activities of daily living, and improved cosmesis. In the subset of obese patients, the benefits of laparoscopy are generally more striking, associated with lower risk of intraoperative complications, fewer surgical-site infections, and shortened hospital stays **(Keus et al., 2006).**

In obesity, the abdominal wall thickness presents a challenge to surgical exposure and technique and is associated with wound-related issues. Laparoscopy effectively overcomes these issues, leading to the belief that laparoscopy for appendicitis is superior to open appendectomy (OA) **(Tatyan et al., 2011).**

Several studies have concluded the contrary. **Ricca et al. in 2007** found a significantly longer operative time and greater overall cost for the LA group, as seen in previous studies on the nonobese. A prospective study by **Towfigh et al. in 2008** found no significant difference between the laparoscopic and open approach in terms of LOS or rate of complications.

These disparities may be a function of variable experience operating on obese patients, which

potentially affects operative time, wound infection rates, and postoperative pain, whereas clinical discretion may affect LOS.

In order to study the outcome of laparoscopic in comparison to open appendectomy, 50 patients who had open surgery were also included in the study. There was no significant difference as regards demographic data and clinical presentation (point of pain).

For the operative details; there was highly significant difference in the operative time between the two groups while there was no difference for blood loss.

Number of analgesics, duration of intravenous antibiotics (days), duration of drainage (days), hospital stay (days) and days to return to normal activities, all show highly significant difference between the two groups.

On comparing between LA and OA complicated patients as regards demographic data, laboratory results, operative and postoperative details there was no significant difference as regards demographic data. As for the clinical presentation (point of pain) and the leucocytic count, the results were comparable.

For the operative details; there was highly significant difference in the operative time and mean blood loss between the two groups.

Number of analgesics, duration of intravenous antibiotics (days), duration of drainage (days), hospital stay (days) days to return to normal activities, all show highly significant difference between the two groups. Post operative complications did not differ when the two groups were compared.

In our study, the total operative time in the LA group was significantly longer the OA group. Our results goes with **Tian-Chong and his colleagues (2017)** who stateded the longer operative, be caused by additional surgical procedures including insufflation, instrument setting, inserting trocars under vision, and laparoscopic exploration of abdominal cavity. Especially in the case of CA, the laparoscopic dissection technique is more complex, and time-consuming. On the contrary, **Aziz and his co-workers (2006)** strongly emphasized that the advantages of laparoscopic surgery have nothing to do with the operative time.

Although incision infection is more common in CA, and is not a severe complication, it has a great influence on the recovery time and living quality **(Garcel et al., 2017).** In our work there is non significant difference in occurrences of wound infection when the results of the two techniques were compared. Our results are contradictory to **Tian-Chong and his co-workers (2017)** who found that the incision infection rate in the group LA was less than that in the OA group which could be due to the use of a specimen bag when removing the appendix, which prevented close contact of the surgical specimen with the wound. It is easy to completely clean the infected fluid in the abdominal cavity in LA. In contrast; it is hard to avoid abdominal wound contact with the infectious liquid and purulent appendix in the OA group. This contradiction may be due to our small sample size.

In our study the dosage of analgesia in OA and LA show significant differenc which goes with the study by **Li et al. (2017)** which shows that amounts of intravenous analgesics of OA group was more than that of LA group. But our results are comparable with **Shuja et al. (2017)** in which the dosage of analgesia in OA and LA was almost similar with no statistical significance.

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