

The Comparison of Open and Laparoscopic Appendectomy: Is There any Outcome Difference Between Non-Complicated and Complicated Appendicitis?

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ABSTRACT

Objective: The assessment of laparoscopic appendectomy (LA) and open appendectomy (OA) in patients with noncomplicated (NCA) and complicated appendicitis (CA) was aimed for.

Material and Methods: Of 279 patients with appendectomy, 135 had NCA (48.3%) (49 underwent LA) (86M, 49F, median 9 years) and 144 had CA (51.7%) (23 underwent LA) (98M, 46F, median 11 years). Outcome measures: Wound infection (WI), intraabdominal abscess (IA), postoperative ileus (PI), requirement of reoperation (RO), time of surgery (TOS), length of stay (LOS), duration of postoperative pain (PP), nasogastric tube (NT), intraperitoneal drainage (ID) were recorded.

Results: Between OA and LA groups, there was no statistical significance in WI(3/86 vs 0/49), IA(2/86 vs 0/49), RO(2/86 vs 2/49), and PI rate (1/86 vs 2/49) in NCA group ($p > 0.05$). The LOS(3 ± 1.4 vs 4 ± 1.3), NT (1.2 ± 0.9 vs 1.8 ± 0.6 days) and PP(0.9 ± 0.9 vs 2.3 ± 1.1 days) were lower in LA than OA ($p < 0.05$). There was no difference in TOS(79.5 ± 27.3 vs 71.6 ± 18.9 min) ($p > 0.05$). In CA, patients with LA had less WI(0/23 vs 18/121) ($p < 0.05$). NT (2 ± 0.8 vs 2.7 ± 1.5), PP (2.1 ± 1.2 vs 3.2 ± 1.5) and ID (3.1 ± 2.3 vs 4.4 ± 1.4) were lower in LA than OA ($p < 0.05$).

Conclusion: Laparoscopic appendectomy decreases wound infection, nasogastric tube duration, intraperitoneal drainage and pain in complicated appendicitis. The Laparoscopic approach is superior in complicated and noncomplicated appendicitis.

Key Words: Non-complicated appendicitis, complicated appendicitis, laparoscopic appendectomy

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Introduction

Laparoscopic appendectomy (LA) has advantages over open appendectomy (OA) in terms of shorter length of hospital stay, less superficial surgical site infection, and better cosmetics in patients with non-complicated appendicitis (NCA) (1, 2). However controversy still exists, particularly in complicated appendicitis (CA) which is described as a perforated appendix with or without abscess formation (3-5). Some authors suggested that LA has an increased risk of postoperative intraabdominal abscess, and prolonged length of stay in complicated appendicitis (6), but others reported that LA is safe, effective, and should be the initial procedure of choice for complicated appendicitis as well (7, 8). We aimed to review our experience with appendicitis to compare OA and LA techniques in children with non-complicated and complicated appendicitis.

Patients and Methods

We retrospectively reviewed 279 patients (184 male, 95 female, median age 9 years) who underwent appendectomy for non-complicated and complicated appendicitis from Feb-

ruary 2006 to November 2009. The patients were divided into two groups as open appendectomy and laparoscopic appendectomy (Table 1). The method of choice of open or laparoscopic was related to the surgeon's preference and availability of endoscopic instruments. The outcome measures were demographic data (age, gender), time of surgery, length of stay, requirement of analgesia, duration of nasogastric tube, superficial surgical site infection, duration of intraabdominal drainage, presence of intraperitoneal abscess, postoperative ileus, and requirement of reoperation (Table 2).

In complicated cases, the adhesions were divided. The purulent fluid between the intestinal segments were drained and washed out. Mostly, the perforated appendix was found to be adhered to intestinal segments or to the abdominal wall. Therefore, the appendix was freed with blunt dissection. The mesoappendix was divided and a regular laparoscopic appendectomy was performed. After washing out of the peritoneal cavity with normal saline, a penrose drain was placed into the Douglas space. All the possible abscess cavities were explored and, if found, they were drained.

The duration of nasogastric tube was determined by the duration of the postoperative ileus. Analgesics were used lib-

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erally and their use was determined by the demand of the patient. No pain scoring was performed. Once the patient tolerated a regular diet, he or she was discharged immediately.

Statistical analysis

After the normality analysis, Chi-square test or One Way ANOVA with Student's t test were used for the comparison of the parameters. In case of abnormal distribution, Fisher's exact test, Kruskal Wallis analysis of variance and Mann-Whitney U tests were performed.

Results

The age and gender were similar in both groups (Table 1). Although no case was converted to open surgery in non complicated appendicitis, in three complicated cases with laparoscopic approach, we converted to open surgery because of technical difficulties.

There was no statistical significance in terms of superficial surgical site infection, intraperitoneal abscess, reoperation, and postoperative ileus rate between OA and LA patients in the non-complicated patients ($p>0.05$). In case of non-complicated appendicitis, the values of length of stay, nasogastric tube, and requirement of analgesia were significantly lower in the LA group than the OA group ($p<0.05$). There was no difference between LA and OA patients in terms of duration of surgery ($p>0.05$) (Table 2).

In complicated appendicitis, we found that patients with LA had significantly less superficial surgical site infection than patients with OA ($p<0.05$). However, significant differences have been not found for intraabdominal abscess, requirement of reoperation, and postoperative ileus ($p>0.05$). In complicated appendicitis, nasogastric tube, requirement of analgesia and intraperitoneal drainage were significantly lower in the LA group than the OA group ($p<0.05$). No statistical difference was found in regard to duration of surgery and length of stay ($p>0.05$) in patients with complicated appendicitis (Table 3).

Discussion

LA is a widely used method with increasing popularity for appendicitis surgery. Although it is well accepted for treatment of NCA, there have been concerns particularly about the longer duration of surgery, superficial surgical site infection and intraabdominal abscess formation in CA (9, 10). The improvement of laparoscopic instrumentation and technical skills have provided safer and successful operations in CA (11, 12). Many studies suggested that LA decreases the rate of superficial surgical site infection and length of stay and provides earlier enteral feeding, with better cosmetic results both in NCA, and CA. LA has some additional advantages over OA, such as improved visualisation of the peritoneal cavity (13, 14).

In the current study, it was found that LA decreased the length of stay, nasogastric tube, and requirement of analgesia dramatically in both NCA and CA. Furthermore, LA has also beneficial effects on the superficial surgical site infection and requirement of reoperation. Therefore, we consider laparoscopy to be a feasible, safe, and efficacious method in both

Table 1. Demographics of the patients

	Open Appendectomy		Laparoscopic Appendectomy	
	NCA	CA	NCA	CA
Number of patients	86	121	49	23
Median age (year)	8	11	10	11
Male/Female	55/28	83/38	28/21	14/9

CA: Complicated appendicitis, NCA: Non-complicated appendicitis

Table 2. The mean values of parameters in non-complicated appendicitis groups

	OA-NCA	LA-NCA	p values
TOS (min)	71.6±18.9	79.5±27.3	$p>0.05$
LOS (day)	4±1.3	3±1.4	$p<0.05$
RA (day)	2.3±1.1	0.9±0.9	$p<0.05$
NT (day)	1.8±0.6	1.2±0.9	$p<0.05$
SSSI	3/86	0/49	$p>0.05$
IA	2/86	0/49	$p>0.05$
ID (day)	0±0	0±0	$p>0.05$
PI	1/86	2/49	$p>0.05$
RO	2/86	2/49	$p>0.05$

TOS: Time of surgery, LOS: Length of stay, RA: Requirement of analgesia, NT: Duration of nasogastric tube, SSSI: Superficial surgical site infection, IA: Number of intraabdominal abscess, ID: Duration of intraperitoneal drainage, PI: Number of post-operative ileus, RO: Requirement of reoperation

Table 3. The mean values of parameters in complicated appendicitis groups

	OA-CA	LA-CA	p values
TOS (min)	96.1±27.4	99.7±25.8	$p>0.05$
LOS (day)	7.1±4.0	5.9±3.4	$p>0.05$
RA (day)	3.2±1.5	2.1±1.2	$p<0.05$
NT (day)	2.7±1.5	2±0.8	$p<0.05$
SSSI	18/121	0/23	$p<0.05$
IA	15/121	2/23	$p>0.05$
ID (day)	4.4 ±1.4	3.1±2.3	$p<0.05$
PI	7/121	2/23	$p>0.05$
RO	10/121	1/23	$p>0.05$

TOS: time of surgery, LOS: Length of stay, RA: Requirement of analgesia, NT: Duration of nasogastric tube, SSSI: Superficial surgical site infection, IA: Number of intraabdominal abscess, ID: Duration of intraperitoneal drainage, PI: Number of post-operative ileus, RO: requirement of reoperation

NCA and CA patients. In patients with CA, the laparoscopy is more advantageous in terms of length of stay, nasogastric tube, requirement of analgesia, superficial surgical site infection and requirement of reoperation. There is no statistical difference between LA and OA groups according to the IA both in CA and NCA patients as in some other studies (15, 16). In the NCA group, no single abscess was found postoperatively

in children with LA. Duration of surgery was not different in LA and OA patients in both the CA and NCA groups. With increased experience in laparoscopic surgery, and especially in recent cases, we observed a trend of reduced duration of surgery in LA patients. We believe that in the forthcoming cases, the surgery will be completed more rapidly at laparoscopy. LA did not increase the duration of surgery and it had faster recovery in perforated appendicitis.

Horwitz et al. and some other investigators reported that the length of stay remained unchanged in patients with CA, when LA was compared to OA (17, 18). In contrast, the current study has a significantly decreased length of stay in patients with LA and CA. Likewise, Yagmurlu et al and many others have similar results to ours in terms of length of stay in patients with CA. The above mentioned investigators showed that LA is a good alternative to the OA and could be the procedure of choice for CA in children (19, 20).

LA has also improved outcomes for requirement of analgesia and postoperative ileus both in complicated and non-complicated appendicitis (21), as in the current study. The duration for requirement of analgesia was longer in the OA group in children both with NCA and CA. Our results showed that the postoperative ileus rate was slightly more in LA patients in both CA and NCA.

The current study has some limitations. Since it is a retrospective study; the selection of patients depended on the choice of the surgeon. The degree of objectivity of the current study would be lower than a similar study designed in a prospective manner.

In conclusion, laparoscopic appendectomy is a very safe and effective method both in complicated and non-complicated appendicitis. Therefore LA should be the standard procedure for all types of appendicitis with few exceptions.

Conflict of Interest

No conflict of interest was declared by the authors.

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