

Laparoscopic Versus Open Appendectomy

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Abstract: Background: Numerous single-institutional randomized clinical trials have assessed the efficacy of laparoscopic and open appendectomy. The results, however, are conflicting. **Objective:** To compare length of hospital stay, duration of the operation, in-hospital complications, and rate of routine discharge between laparoscopic and open appendectomy. **Methods:** Patients with primary ICD-9 procedure codes for laparoscopic and open appendectomy were selected from the inpatient sample, 120 representing 20% of all Alwahda hospital discharges, Derna, Libya, during the year 2006. In addition, 30 inpatient underwent laparoscopic appendectomy at St. Marian hospital, Mulheim an der Ruhr, Germany. **Results:** Thirty (30) patients (20%) underwent laparoscopic and 120 patients (80%) open appendectomy. Patients had an average age of 26.7 years. Laparoscopic appendectomy was associated with shorter median hospital stay (laparoscopic appendectomy: 2.3+0.9 days, open appendectomy: 3.7+1.2 days, $P < 0.001$), lower rate of infections (odds ratio [OR] = 0.4 [0.38, 0.66], $P < 0.001$), decreased gastrointestinal complications (OR = 0.8 [0.68, 0.96], $P = 0.02$), lower overall complications (OR = 0.84 [0.75, 0.94], $P = 0.01$), and higher rate of routine discharge (OR = 2.8 [2.5, 4.5], $P < 0.001$). **Conclusions:** Laparoscopic appendectomy has significant advantages over open appendectomy with respect to length of hospital stay, rate of routine discharge, and postoperative in hospital morbidity.

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1. Introduction:

Appendicitis is the most common intra-abdominal condition requiring emergency surgery.[1], Appendicitis is the most common non-traumatic surgical abdominal emergencies in children. [2], In the pediatric population, the benefits of LA as compared with OA remain undefined. Children represent a group of patients who would benefit greatly from reduced postoperative complications, earlier mobilization, and ultimately discharge from hospital, particularly because of the potential disruptive effect of illness on their lives. Although much research has been done to compare results from LA and OA in children, conclusions have been difficult to draw because of small study size, presence of only a handful of randomized trials, and possible heterogeneity in patient characteristics, surgical practice, and severity of appendicitis between these studies. At present, therefore, there is no consensus between pediatric surgeons as to the benefits of LA over OA.[3], Appendectomy has been the treatment of choice for acute appendicitis.[4], For more than a century, OA remained the gold standard for the treatment of acute appendicitis. The advent of endoscope surgery led to the idea of performing LA. More than 2 decades later, the benefits of LA are still controversial. Despite numerous case series and small, single-institutional randomized clinical trials comparing LA versus OA, a consensus concerning the

relative advantages of each procedure has not yet been reached.[5]

The aim of the present study was to compare length of hospital stay, duration of the operation, in-hospital complications, and rate of routine discharge between laparoscopic (LA) and open appendectomy (OA).

Subjects and Methods:

One hundred and twenty (120) patients with procedure codes for LA or OA were selected from the inpatient sample during 2006 at Alwahda Teaching Hospital, Derna, Libya. In addition, 30 inpatient underwent laparoscopic appendectomy at St. Marian hospital, Mulheim an der Ruhr, Germany. Patients with diagnoses other than appendicitis were excluded from analysis (Appendix A). Data provides demographic data, admission and discharge dates, discharge status, preoperative risk factors, postoperative complications, and vital status of patients discharged. The procedure and diagnostic codes are classified according to the International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9, CM).

In-Hospital Complications.

Complications were grouped into categories (mechanical wound complications, infections, urinary complications, pulmonary complications, gastrointestinal complications, cardiovascular complications, systemic complications, complications during procedure; Appendix B).

Evaluation of the presence of abscess or perforation assessed with (ICD-9 540.0 and 540.1) and without presence of appendiceal perforation or abscess (ICD-9 540.9, 541, and 542). All statistical analyses were performed using SPSS version 12.0. Differences between laparoscopic and open procedures with respect to baseline socio-demographic, co-morbidity, and other predictor variables were tested using t-tests, χ^2 tests, analysis of variance and multiple linear regression models[6]

3. Results

Data contained information about 150 patients who underwent LA or OA. Thirty patients (20 %) underwent LA and 120 patients (80 %) underwent OA. Patients were on average 26.7 years old. Perforated appendices and appendiceal abscesses were present in 20.2% and 12.7%, respectively. Patients who underwent LA were more likely female (LA: 50 % female, OA: 40 % female).

Table (1) show that patients undergoing LA had a significantly shorter median length of hospital stay (LA: 2.3+0.9 days, OA: 3.7+1.2 days, $P < 0.001$), and shorter time of operation (LA: 20+12 min., OA: 29+14 min., $P < 0.002$).

Table (2) show that the rate of infections (LA: 3.3 %, OA: 5.8 %, $P < 0.001$), gastrointestinal complications (LA: 3.3%, OA: 5 %, $P < 0.02$), Fistula complications (LA: 3.3%, OA: 5 %, $P < 0.05$), and overall complications (LA: 10 %, OA: 19.1%, $P < 0.001$) were significantly lower in patients undergoing LA.

LA remained associated with shorter median hospital stay (LA: 2.3 days, OA: 3.7 days, $P < 0.01$), lower rate of infections (odds ratio [OR] = 0.4 [0.38, 0.66], $P < 0.001$), decreased gastrointestinal complications (OR = 0.8 [0.68, 0.96], $P = 0.02$), lower overall.

Table 1: Patients Demographic Data.

	LA	OA	t test	P
	Mean +SD	Mean +SD		
Age / year	27.7+12	26.5+ 14	0.2	> 0.05
Operation duration/ min	20+ 12	29+14	10.5	< 0.002*
Hospital stay/days	2.3+0.9	3.7+1.2	35.5	< 0.001*

Table 2: In-hospital complications in Laparoscopic vs. Open appendectomy.

Code ICD9	complications	LA		OA		OR	CL	P
		No.	%	NO.	%			
998.6	Mechanical fistula	1	3.3	6	5	0.66	0.45-0.84	0.05
998.59	Infection :wound	1	3.3	7	5.8	0.4	0.38-0.66	0.001
998.59	Infection: IA abscess	nil	nil	2		1.6		
997.4	GIT: obstruction	1	3.3	6	5	0.8	0.68-0.96	0.02
997.4	GIT: ileus							
998.89	Systemic: fever	nil	nil	2	1.6			
998.5	urinary	nil	nil	nil	nil			
997.3	pulmonary	nil	nil	nil	nil			
997.1	cardiovascular	nil	nil	nil	nil			
	Over all complication	3	10	23	19.1	0.84	0.75-0.94	0.01
	Gender: femal	15	50	48	40	1.5	0.6-2.6	
	Routine discharge	28	93.3	100	83.3	2.8	2.5-4.5	0.001

4. Discussion:

This analysis comparing length of hospital stay, postoperative in-hospital morbidity and mortality, and rate of routine discharge in patients undergoing LA and OA.

In the present study, patients undergoing LA had a significantly shorter median length of hospital stay (LA: 2.3 days, OA: 3.7 days, $P < 0.001$) and higher rate of routine discharge (OR = 2.8 [2.5, 4.5], $P < 0.001$) compared with OA patients. Patients after LA

had significantly less postoperative infections (OR = 0.4 [0.38, 0.66], $P < 0.001$), gastrointestinal complications (OR = 0.8 [0.68, 0.96], $P = 0.02$), and overall complications (OR = 0.84 [0.75, 0.94], $P = 0.01$). The question of whether LA decreases the length of hospitalization has been a matter of great debate over the past decade[.5,7] The literature provides contradictory results. Although some recent retrospective cohort studies or chart reviews found LA associated with significantly shorter hospital stay,

[8,9,10] other retrospective investigations reported non significant differences.[11, 12] Similarly, some randomized controlled trials associated LA with decreased hospital.

Stay; [13, 14] however, others report no significant difference between LA and OA.[19,21] whereas another meta-analysis failed to show a statistically significant difference in length of hospital stay between LA and OA.[23]

Some investigations found significantly higher postoperative wound infections after OA,[17,18,20,24,25] whereas others reported similar rates.[7,13,26] In a recent meta-analysis, Golub and colleagues found a wound infection rate for LA that was less than half the rate in patients undergoing OA.[22] Conversely, the authors reported an increase in the rate of intra-abdominal abscesses after LA, which failed, however, to reach statistical significance. Other meta-analyses confirm these findings.[23]

Two studies reported the incidence of postoperative wound infection, showing a statistically significant reduction in the LA as compared with the OA group.[12,25] Metaanalysis of studies showed a significantly reduced incidence of wound infection of 1.5% (30 of 2016) in LA compared with 5% (87 of 1739) in OA, odds ratio (OR) of 0.45, and confidence interval (CI) of 0.27 to 0.75. 3

In the present study, a lower rate of postoperative infections between the LA and OA group was found (OR = 0.4 [0.38, 0.66], $P < 0.001$). It is impossible, however, to disentangle wound infections from intra-abdominal abscesses as the ICD-9 codes are identical for both complications (998.59). Besides overall complication rate and postoperative infections, the occurrence of gastrointestinal complications was significantly rarer in LA patients (OR = 0.8 [0.68, 0.96], $P = 0.02$). The answer to the question as to why wound infection might be reduced during LA is unclear. A possible reason for this is that in open appendectomies the appendix is delivered directly through the wound, thereby risking contamination; whereas in laparoscopic surgery this is delivered wither via a bag or into a laparoscopic port. It may also be related to the small size of individual port-site wounds during LA as compared with the longer single wound in OA.3 In most of randomized clinical trials comparing LA versus OA, no mortality was reported in either group.[11,15], This is to be expected because appendicitis is a disease that disproportional strikes young, healthy people, and appendectomy is a low-risk surgical procedure.

Routine discharge was significantly higher in patients undergoing LA versus OA (OR = 2.8 [2.5, 4.5]). Patients after LA were approximately 3 times more likely to be discharged routinely compared with OA patients. Several studies found LA to be

associated with significantly earlier return to normal activities compared with OA.[7,15,24] It has been reported that the presence of appendiceal perforation or abscess is associated with poorer outcome. Most studies, however, did not stratify the findings by the presence of perforation or abscess as their patient numbers were too small for subset analyses. In a large retrospective study, stratified analyses were performed for patients with and without perforation. The average length of hospital stay was significantly shorter for LA patients with and without perforated appendicitis. Similar results regarding length of hospital stay were reported by Martin and associates.[16] No differences, however, were found in either group for return to normal activity.

In the present study, median length of stay was shorter ($P < 0.001$) and the rate of routine discharge higher ($P < 0.001$) for patients undergoing LA, regardless of whether abscess or perforation was present.

Laparoscopic appendectomy is safe alternative to conventional open appendectomy, leading to early ambulation, decreased hospital stay, and better exploration of abdominal cavity. [27,28, 30-33]The Global Operative Assessment of Laparoscopic Skills (GOALS), developed by Vassiliou and colleagues, has construct validity in the assessment of surgical residents' laparoscopic skills in dissection of the gallbladder from the liver bed. laparoscopic appendectomy. Scores for five domains (depth perception, bimanual dexterity, efficiency, tissue handling, and autonomy) were recorded and provides additional evidence in support of GOALS as an assessment tool for objectively measuring technical skills in laparoscopic surgery.[29]

It could be concluded that LA has significant advantages over OA with respect to length of hospital stay, rate of routine discharge, and postoperative in hospital morbidity. Findings may have important health care implications, not only resulting in clinical patient benefit, but also lowering hospital costs. Exponentially increasing health costs have stimulated a massive health care reform effort, seeking cost containment. However, all aspects of LA and OA must be compared, including postoperative pain, patient's quality of life, days away from work, procedural costs, total costs, and long-term complications.

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