Journal of Population Therapeutics & Clinical Pharmacology

Comparison of the post-operative outcome of laparoscopic appendectomy(LA) and open appendectomy (OA) by analyzing the operative time, post-operative recovery and complications

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ABSTRACT
Objective*; The study aims to compare the post operative outcome of laparoscopic appendectomy(LA) and open appendectomy (OA) by analyzing the operative time, post-operative recovery and complications.*
Methods*; All children presented to department of paediatric surgery, Maternity and children hospital(MCH) Buraidah with acute appendicitis over a consecutive period of three years (Jan 2007 to Jan 2010) were included in the study. Operative time, analgesia, time to resume feed, complications and hospital stay were recorded retrospectively.*
Results*; 215 patients aged 3 to 12 years, underwent appendectomies. 101 had LA, 111 underwent OA and 3 were converted and excluded from further analysis. Mean operative time for LA was 72.62±24.16 versus 46.85±16.03 minutes in OA (P<0.001). Feed resumption was after 16.50 ±6.01h in LA and 27.02±15.64h in OA, (P < 0.001). Wound infections were 0.99% in LA and 6.30% in OA, (P = 0.042). There were 3.96% residual abscesses in LA and 4.5% in OA, P = 0. 844.Small bowel obstruction was 0.99% in LA and 5% in OA, P=0.123. Mean postoperative stay for LA was 2.98± 1.49days and 3.82±2.10 for OA, (P=0.001)*
Conclusion*: Early resumption of feeds, shorter hospital stay, lesser incidence of small bowel obstruction, comparable intra-abdominal abscess rate, and significantly less wound infection rate makes LA an attractive alternative to OA.*
Keywords: *Appendicitis, Laparoscopic Appendectomy, Open Appendectomy.*

INTRODUCTION

Appendectomy is one of the most common emergency operations in children [1]. Many centers have adapted laparoscopic appendectomy (LA) in preference to open appendectomy (OA). The first laparoscopic appendectomy in children was performed in 1988[2]. Still, benefits of laparoscopic appendectomy remain undefined. Many are still skeptical of LA because of the increased cost, and longer operative time. Some studies have suggested increased risk of postoperative intraabdominal abscess formation in cases with complicated appendicitis [3].

However, many feel that improved wound healing, reduced postoperative pain and ultimately earlier discharge have made LA a favorable treatment option even in complicated appendicitis [3]. Recent studies have shown that there is no increased risk of postoperative intra-abdominal abscess in LA [4]. Although advantages of LA have not yet been clearly proven, LA definitely provides diagnostic advantages as compared to conventional OA and cosmetic benefits. We hypothesized that LA is more

beneficial than OA in all types of appendicitis. The purpose of this retrospective study was to compare certain per-operative and post-operative variables of the patients who presented with appendicitis, whether simple or complicated to determine the outcome.

PATIENTS AND METHODS:

All the children admitted in Department of pediatric surgery, Maternity &Children's Hospital, Buraidah Al-Gassim, Saudi Arabia with appendicitis for appendectomy over a 3 years period from 1-1-2007 to 31-1- 2010. Appendectomy was attempted and successful in all the patients. Patients, who had conversion from LA to OA and diagnosis other than acute appendicitis on laparoscopy or laparotomy like mesenteric lymphadenitis, Meckel's diverticulitis and ovarian pathologies in girls, were excluded from the study. All the consecutive patients admitted under the care of one consultant had LA and the other patients in the department were managed by open appendectomies. Operations were performed by a team of consultant and trainee registrars experienced in open and laparoscopic techniques. Open appendectomies were completed using a small right lower quadrant incision and laparoscopic appendectomies were performed by using 3 ports: one umbilical, one in the left iliac fossa and the other one in the suprapubic region. Umbilical 5 mm port was changed to 10 mm port for extraction of the appendix whenever it was necessary.

Operative findings were categorized clinically as acute gangrenous, perforated appendicitis or appendicular mass confirmed by histopathology. All categories except simple acute appendicitis were included in the group of complicated appendicitis. One gm Ampicillin was added to 500 ml of normal saline and peritoneal cavity was irrigated thoroughly at the end of procedure in both groups, and no drains were used in either group. All wounds were closed primarily with subcuticular absorbable suture.

Intravenous Ampicillin 25mg/kg/6h, Gentamycin 2.5mg/kg/8h and Metronidazole 7.5 mg/kg/8h were started in all the patients preoperatively once the diagnosis had been established. The same antibiotics were continued post operatively in both groups. Antibiotics were changed postoperatively if indicated depending on results of the peritoneal swab culture. Pain assessment was done by using FACES pain scale for 7 to 12 years old children, while FLACC scale for children from 3 to 7 years of ages. 1mg/kg/ IV pethidin was given at score of 3 or more and number of pethidin doses, given in first 24 hours of surgery was recorded. children were assessed after 12 hours of surgery for resumption of feed and who do not had vomiting and audible bowel sounds were started liquid diet and others were kept NPO with reassessment after every 6 hours for resumption of feed . Criteria for discharge were similar in both groups: Afebrile for at least 24 hours, tolerating regular feed, ambulating with adequate pain control, and a WBC $<10x\ 10^9$ /L. If the patient met all criteria, but if still the white count was elevated, then he was sent home on antibiotics and white count repeated after three days, then further course of action was determined.

Retrospectively, the patient age, gender, operative findings, operative time, analgesia requirement, resumption of feed, postoperative complications and hospital stay were recorded. Data were recorded as mean ± standard error of the mean. Nominal data (e.g. Operative findings and complications) were compared by a Fisher's exact test and continuous data (e.g., length of postoperative stay) were compared by analysis of variance using scheffe Samer F procedure. P value of <0.05 was considered significant.

RESULTS;

During the study period, 215 children aged 3 to 12 years (mean, 8.64±2.32) underwent appendectomy for acute appendicitis. 101 (47%) patients had LA, whereas 111(51%) had OA. Three patients (1.4 %), in very early stages of this study were converted from LA to OA and were excluded from further consideration.

Table1:

Comparison of Laparoscopic appendectomy (LA) and Open appendectomy (OA)

	LA	OA	
Number	101(47%)	111(51%)	Conversion 3(1.4%)
OR time(min)	72.62±24.16	46.85±16.03	P<0.001
Complicated appendicitis	39(38.6%)	39(35.1%)	P = NS
Pethidine (doses/24h)	1.93±1.31	1.95±1.60	P=NS
Resumption of feed(h)	16.50 ±6.01	27.02±15.64	P < 0.001
Overall complications	5.94%	15.3%	P=0.023
Wound infection	1(0.99%)	7(6.30%)	P = 0.042
Residual abscess	4(3.96%)	5(4.5%)	P = NS
SBO	1(0.99%)	5(4.5%)	P = NS
Post-op stay (days)	2.98 ±1.49	3.82 ±2.10	P = 0.001

OR time=operative time, SBO= small bowel obstruction, pethidine = number of pethidine doses given in first 24 hours

The mean operative time was 72.62±24.16 minutes for LA group and 46.85±16.03 minutes for OA group (P<0.001) .In LA group 62 (61.3 %) had simple acute appendicitis, 18(17.8%) had gangrenous appendicitis, 14 (13.8%) had perforated appendix, and eight (7.9%) patients had appendicular mass. In OA group, 72 (64.9%) had simple acute appendicitis, 23 (20.7%) had gangrenous appendicitis, 14(12.6%) had perforated appendix and two (1.8%) patients had appendicular mass. Total doses of pethidine in the first 24 hours were1.93±1.31 in LA and 1.95±1.60 in OA (P=959). Postoperatively the time to resume the oral feed was 16.50 ±6.01 hrs in LA, where as 27.02±15.64 hrs in OA (P < 0.001). Total complication rate was 5.94% in LA and 15.3% in OA, P =0.023. Wound infection was one (0.99%) in LA group, whereas seven (6.30%) in OA group (P = 0.042). Four patients (3.96%) in LA group developed intraperitoneal abscesses while five patients (4.50%) in OA group had this complication (P = 0.844). One (0.99%) LA patient had postoperative adhesive intestinal obstruction versus five (4.50%) in the OA group. (P = 0.123). The mean postoperative stay for LA was 2.98 ±1.49 days and it was 3.82 ±2.10 in OA group (P = 0.001). There was no mortality in either group. These data are further summarized in Table 1.

DISCUSSION

LA has emerged as a safe alternative in the treatment of acute appendicitis in children. However, its application in perforated appendicitis is contentious [5]. In 1994, Frazee et al [6] randomized 37 patients to open appendectomy and 38 to laparoscopic appendicectomy. They reported that the operative time was longer in laparoscopic appendicectomy group (87 vs. 65 minutes). In our study also, operating time was significantly higher in LA than in OA. Horwitz et al [7], Valla et al [8] have suggested avoiding laparoscopic approach in complicated appendicitis. Mallick et al [9], performed LA in 59 patients with complicated appendicitis and none of them developed intra-abdominal collection. They were able to remove appendices in 85% of appendicular masses totally by laparoscopic approach. We have successfully done LA in 39(38.6%) patients with complicated appendicitis, out of which 13.8% had perforated appendix, 17.8% had gangrenous appendix, and 7.9% patients had appendicular mass. Our findings support the feasibility and safety of LA for complicated appendicitis.

In many studies, it has been concluded that there is less opioid analgesia requirement in LA group, but in a study done by York et al [10], they claimed that IV opiates requirement was similar in both groups. In our study the total number of doses of opioid analgesia required for LA group were 1.93±1.31 versus 1.95±1.60 for OA group (P=NS). Thus, suggesting that there is no significant difference in opioid analgesia requirement between the two groups. York et al [10] in their study found that the time for

resumption of diet was 17.6 h in LA and 28.6 hours for OA. Our LA group took 16.50 ±6.01hours to resume diet, whereas in OA group this time was almost double, 27.02±15.64 ($P < 0.001$). This faster return to diet in patients with LA may be due to less abdominal wall trauma and minimal manipulation of the intestine during laparoscopic procedure.

The risk of wound infection is less in LA compared to the open procedure. A meta-analysis of randomized controlled trials has been reported with outcomes of 2877 patients from 28 trials. Overall complication rates were comparable, but wound infections were definitely reduced after laparoscopy (2.3% to 6.1%) [10]. we had 0.99% (1/101) wound infection in LA group and 6.30% (7/111) OA group ($P = 0.042$). A possible reason for less wound infection in LA is that in OA the appendix is delivered directly through the wound, thereby risking contamination, whereas in laparoscopic surgery this is delivered via bag or through a laparoscopic canula. One wound infection in our LA group was due to extracting the appendix through the port site. After this we changed our policy for extraction of specimen and started replacing 5mm umbilical port with 10mm at the end of the procedure for extracting the appendix. Our wound infection rate in LA group has been nil since we implemented this policy.

Earlier studies had shown a significantly increased incidence of postoperative intra-abdominal abscess after LA. In a meta-Analysis by Aziz et al, the incidence was 7.4% in LA while it was 4.2% in OA group [3]. In a study by Kehagias et al [12], it was significantly more in LA 5.3% versus 2.1% in OA. Barkhausen et al [4] and Caravaggio et al [13] in their studies concluded that the incidence of intra-abdominal abscess formation rate was same in both groups In contrast, studies by Konstantinidis et al [14] and by Mallick MS[9], the incidence of intra-abdominal abscess was less in the LA group. In our study, four patients in the LA group (3.96 %,) developed intraabdominal abscesses as confirmed by ultrasound. One patient needed laparoscopic drainage of the pus while others settled on conservative management. In the OA group there were five patients with intra-abdominal abscess (4.50%). Two of these patients needed surgical drainage while the remaining three settled on conservative management.. Thus, there was no significant difference in the incidence between the two groups. We reviewed our practice and realized that we were discharging our LA patients home early even when their WBC counts were more than $10x\ 10^9$ /L, because they were clinically well and afebrile. Since then we have started discharging them home on oral antibiotics, if WBC count is more than $10x\ 10^9$/L. White count is repeated again after three days of outpatient antibiotic therapy to decide further course of action.

Adhesive small bowel obstruction (SBO) is also an important complication following appendectomy. Tsao KJ et al [15] have compared the risk of SBO after 1105 appendectomies in children .In their study 7 patients (1.46%) in OA group had developed SBO, while 1 patient (.16%) in LA group had SBO ($P = 0.01$) . We had SBO 0.99 % in LA group, while 4.50% in OA, (P=NS). Two of the patients from OA with SBO needed laparotomy for adhesiolysis. The overall risk of SBO after appendectomy in children is low and is largely related to whether appendix was perforated or not. Although our data did not show significant difference between the two groups because of small sample size, it is probably safe to assume that laparoscopic procedure leads to fewer intra-abdominal adhesions because of minimal tissue handling and trauma. length of postoperative hospital stay varies amongst different studies, but in most of the studies hospital stay in LA is shorter than OA. Schmelzer et al [16] in their study found a shorter postoperative hospital stay. It was 2.2 days in LA, while OA patients stayed at hospital for 3.4 days postoperatively (P=0.004). Kehagias et al [12], also noticed that LA was associated with a shorter hospital stay than OA (2.2 days versus 3.1 days P =0.04). In our study also the mean postoperative hospital stay in LA was significantly less than OA group (P=0.001). This shorter postoperative hospital stay in laparoscopic group might be related to, early resumption of oral feed, quicker ambulation.

Unlike adult surgeons, where there is high incidence of lap.cholecystectomy, there are less options available for pediatric surgical trainees to refine their laparoscopic surgical techniques.. We feel that LA provides a good opportunity for the trainees and operating room staff to keep in constant touch with laparoscopic procedures and equipment.

CONCLUSION

LA has longer operative time than OA. But LA group has early resumption of feeds, shorter hospital stay, lesser incidence of small bowel obstruction and significantly less wound infection rate. The incidence of intra-abdominal abscess is comparable. LA is an acceptable alternative to OA with some benefits and excellent cosmesis.

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