Laparoscopic appendicectomy for complicated appendicitis in children

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ABSTRACT

Introduction: The place of laparoscopic appendicectomy in the management of complicated appendicitis remains unsettled with reports of a higher incidence of postoperative intraperitoneal abscess. Most studies on laparoscopic appendicectomy in children have been done in the Western population. This retrospective review was done to compare laparoscopic appendicectomy with open appendicectomy in children with complicated appendicitis in a hospital in Malaysia.

Methods: The laparoscopic appendicectomies were done by a single surgeon, while the open appendicectomies were performed by surgical trainees with at least three years of surgical experience. There was no selection of cases for laparoscopic appendicectomy. Both procedures were done by standard techniques. The operative time, duration of postoperative stay, wound infection rate, incidence of intraperitoneal abscess and postoperative fever were compared.

Results: Based on the intention to treat analysis, there were 51 and 61 children in the laparoscopic and open appendicectomy groups, respectively. Conversion from laparoscopy to open technique was done in six children. Distribution of age, gender and pathology of appendicitis was similar for the two groups. With laparoscopic appendicectomy, the mean operative time was longer (112 vs. 72 minutes, p-value is less than 0.005), while severe wound infection (2.1 vs. 21 percent, p-value is less than 0.05) and mean postoperative hospital stay (5.7 vs. 7.4 days, p-value is less than 0.005) were significantly lower. The incidence of postoperative intraperitoneal abscess (12 vs. 11.5 percent) and postoperative fever (20 vs. 11.5 percent) were not significantly different (p-value is greater than 0.05).

Conclusion: This review has confirmed that the longer the operating time, the lower the incidence of wound infection and the shorter the postoperative stay for laparascopic appendicectomy. There was no increased risk of postoperative intraperitoneal abscess.

Keywords: children, complicated appendicitis, laparoscopic appendicectomy, open appendicectomy

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INTRODUCTION

Laparoscopic appendicectomy (LA) has the advantage of providing better access and good visualisation of the peritoneal cavity with relatively smaller incisions, as compared to open appendicectomy (OA). Logically, LA should be beneficial in the management of complicated appendicitis which is often associated with inflammatory masses, omental adhesions and intraperitoneal abscesses.[1,2] Laparoscopy also helps to correct preoperative diagnosis in clinically-doubtful cases of appendicitis. However, despite these advantages, the place of laparoscopy in complicated appendicitis in children still remains a matter of debate.[2,3] The issue has also been complicated by some reports that LA may be associated with a higher risk of postoperative intraperitoneal abscess.[1,2] Most studies that have compared LA with OA on complicated appendicitis in children have been in the Western population and the regional literature on the subject is limited.

METHODS

A retrospective review was done to compare LA with OA in children (aged 12 years or less) who had undergone emergency appendicectomy for complicated appendicitis over a period of five years from January 2002 to December 2006. Complicated appendicitis in this study has been defined as the presence of one or more of the following pathological changes involving the appendix and the peritoneum, namely perforation, gangrene, mass formation or intra-abdominal abscess. LA was performed by the same consultant surgeon, while OA was performed by surgical trainees with general surgical experience of not less than three years. There was no selection of patients for LA

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and all patients scheduled for appendicectomy under the consultant surgeon primarily underwent LA. The surgical trainees were involved in assisting the LA. Both LA and OA were done under general anaesthesia and all patients received perioperative antibiotics with intravenous third generation cephalosporin and metronidazole.

LA was performed using a 10-mm trocar at the umbilicus as a camera port, a 5-mm trocar in the right flank about the level of the umbilicus and a 3-mm trocar just above the pubic symphysis. The mesoappendix was dissected using ultrasonic dissector and the appendix stump was ligated using either an endoloop or intracorporeal knot. The position of the two working ports was slightly varied as per the operative findings after visualisation through the camera port. The appendix was extracted either within the umbilical trocar or by use of a bag, when required. After removal of the ports, the fascia was sutured at the umbilicus and intracutaneous sutures were used to close the 10-mm and 5-mm trocar sites. OA was performed through a muscle-splitting incision in the right iliac fossa. The appendicectomy was done by standard technique. Peritoneal lavage was done in both techniques using sufficient normal saline till all the collections have been visibly cleared and the effluent was clear in appearance. Volumes ranging 1–1.5 L were required in our cases. In both LA and OA techniques, the distal ileal loops were traced for about 15–20 cm. All visible interloop adhesions and exudates were cleared. Intraperitoneal drains were not used for both LA and OA in view of the good peritoneal lavage used in all cases and unreliability of such drains.

The demographical features such as age, gender and race, as well as the pathological changes in the appendix were recorded. The pathology in the appendix was classified as perforation, gangrene or appendicular mass/abscess. Patients with appendicular mass or abscess formation were grouped under this category even though the appendix also showed either perforation or gangrenous change. After surgery, all patients received antibiotics either for a minimum period of five days or for at least 48 hours after the patient remained afebrile, whichever was longer. The antibiotics were initially given intravenously and changed to oral route when oral feeds were commenced. The operative time, postoperative inpatient days, postoperative adverse events, such as wound infection, significant postoperative fever and intraperitoneal abscess, were compared between the LA and OA groups. The operating time for LA was taken as the interval from the time of umbilical incision to closure of the port sites, and that for OA from the time of right iliac fossa incision to completion of wound closure.

Wound infection for the purpose of the study was grouped into mild and severe, using a modification of the National Nosocomial Infection Surveillance (NNIS) system classification.[4] Mild infection was defined as the presence of minimal seropurulent or purulent discharge, which settled with either oral antibiotics or dressings for three days or less and did not delay the patient's recovery from surgery. Severe wound infection was defined as the presence of moderate seropurulent or frank purulent discharge with or without systemic symptoms, which required dressing for more than three days or required surgical intervention. Postoperative fever was defined as the presence of fever of > 38°C beyond the second postoperative day. Postoperative intra-abdominal abscess was defined as the presence of intraperitoneal collection demonstrable by ultrasonography or surgical drainage. Statistical analysis was done using unpaired *t*-test for continuous variables and chi-square test for discreet variables with Yates' correction where applicable. A p-value of < 0.05 was taken as significant.

Table I. Demographic features and distribution of appendicular pathology in the laparoscopic and open surgery groups.

Demographics	No. (%) LA (n = 51)	No. (%) OA (n = 61)	p-value
Age (years)			
Range	5–12	4–12	
Mean (median)	8.7 (9)	9 (9)	> 0.05 (NS)
Gender			
Male	26 (50.9)	28 (54.1)	
Female	25 (49.1)	33 (45.9)	> 0.05 (NS)
Race			
Malay	22	28	
Chinese	23	24	
Indian	6	9	> 0.05 (NS)
Appendicular pathology			
Perforated	33	39	
Gangrenous	12	17	
Abscess/mass	6	5	> 0.05 (NS)

LA: laparoscopic appendicectomy; OA: open appendicectomy; NS: not significant

RESULTS

A total of 189 children underwent appendicectomy for acute appendicitis during the study period, of which 112 had complicated appendicitis. Of these, 45 had the appendicectomy completed by laparoscopy, 61 had OA, and six required a conversion from LA to OA. Intention to treat principle was used to analyse the results. The age of the patients ranged 5–12 years for the LA group and 4–12 years for the OA group. The males constituted 50.9% of the LA group and 54.1% of the OA group. There was no statistically significant difference between the LA and OA groups with regard to demographical features such as age, gender and race as well as the pathological changes

involving the appendix (Table I). The mean operative time for the LA group was 112 (range 50–163, with 5% trimmed mean of 114, standard deviation [SD] 36.3 and 95% confidence interval [CI] of 104–124) min and that for the OA group was 72 (range 40–137, with 5% trimmed mean of 72, SD 30.3 and 95% CI 64–79) min. The operative time was significantly longer for the LA group ($p < 0.005$).

One or more of the three postoperative adverse events noted above occurred in 18 of the 51 patients (35%) in the LA group and 42 of 61 (69%) in the OA group. Postoperative complications as a whole were more frequent after OA (p with Yates' correction < 0.005). Severe wound infection occurred in 13 of 61 (21%) of the OA patients and in two of the 51 (4%) patients of LA group. Severe infection occurred significantly less frequently with the LA group (p with Yates correction < 0.05, odds-ratio [OR] 0.23, 95% CI 0.07–0.67). Mild wound infection occurred in one of the 51 (2%) patients of the LA group and in 21 of 61(34%) of the OA patients.

Postoperative intraperitoneal abscess developed in six of 51 patients (12%) in the LA group and seven of 61 children (11.5%) in the OA group (Yates' $p > 0.05$). The locations of the collections in the LA group were interileal in three and pelvic in three patients. The locations in the OA group were interileal in two, pelvic in three and two in the right iliac fossa. Except for one patient in each of the LA and OA groups requiring surgical drainage of the pelvic abscess, all other patients responded to conservative treatment with antibiotics. Postoperative fever occurred in ten of the 51 (20%) patients in the LA group and seven of the 61 (11.5%) children in the OA group. There was no statistically significant difference between the two groups (Yates' $p > 0.05$). The mean periods of postoperative hospital stay were 5.7 (range 2–14, SD 1.93, 95% CI 4.9–6) days for the LA group, and 7.4 (range 5–13, SD 1.86 and 95% CI 6.8–7.8) days for the OA group, respectively. The postoperative stay for the LA group was significantly shorter ($p < 0.005$).

DISCUSSION

Most existing studies on LA in children have compared this group with those undergoing OA with regard to operative time, duration of postoperative stay and postoperative complications such as postoperative fever, postoperative ileus, wound infection and postoperative intraperitoneal abscess formation.[2,3,5-7] A longer operative time is often quoted as a disadvantage of LA compared to OA. A report on children treated for perforated appendicitis from another centre in the region showed a statistically significant difference in mean operative time of 106.5 min (95% CI 100.2–112.8) in the LA group and 92.8 min (95% CI 82.9–102.7) in the OA group.[6] The longer mean operative time of 112 minutes for the LA group in our cases of complicated appendicitis is thus similar. The time taken for laparoscopic dissection in complicated appendicitis depends on the severity of the pathological changes in the abdomen and the optimal positioning of the working ports. The presence of ileus, inflammatory oedema and interloop adhesions together with the varied position of the appendix may make the initial identification of the position of the appendix through the camera port difficult, resulting in a less than optimal position of the working ports.

Most studies have shown a significantly reduced incidence of wound infection with LA compared with that of OA.[2] Our study that is confined to cases of complicated appendicitis has also shown the lower incidence of both mild and severe wound infections with LA. The reduction in the number of wound infections is possibly due to the small size of the individual port-site wounds compared with the longer wounds in OA.[2,3] The multiple layers in the abdomen which are opened up in OA allow infected material to collect, thus promoting wounds infection. In LA, the appendix is taken out via a bag or through the laparoscopic cannula, in contrast to open delivery through the wound in OA. The suction and irrigation of the intraperitoneal collections are done via a suction device passed through the laparoscopic port in LA, whereas such maneuvres easily contaminate the wound of OA despite protection with packs.

The incidence of intraperitoneal abscesses following LA for complicated appendicitis in children has been variably reported, with some studies showing no difference compared to OA, while others have shown a higher incidence.[2] The reason for the increase in the incidence of intraperitoneal abscesses following LA is perplexing as laparoscopy provides better access to all parts of the peritoneal cavity, enabling easier detection, effective drainage and irrigation of localised collections during appendicectomy.[1-3] The general bias of selecting LA for bigger-sized children with a fat-laden peritoneum may contribute to this higher incidence.[7] Our review which is confined to cases of complicated appendicitis and is matched for severity of appendicitis between the LA and OA groups, has not shown any significant difference in intraperitoneal infections following LA.

Most reports have shown that the length of postoperative hospital stay is significantly less following LA compared with OA.[2] This has also been shown in our patients. Factors, such as early ambulation following surgery, reduction in wound pain, decreased use of postoperative analgesics, reduced incidence of ileus and

wound infection, may collectively lead to reduction in postoperative inpatient days. However, it needs to be mentioned that our retrospective analysis has the limitation of variability in the experience of the surgeons between the LA and OA groups. This variability was to some extent minimised by adopting a standard protocol for both LA and OA and by ensuring a minimum of three years of surgical experience for the surgical trainees. It is inevitable that any new procedure that is adopted in clinical practice tends to be done by senior members. Such a bias has been noted in many of the published reports comparing LA with OA.[2]

In conclusion, the present report happens to be the first detailed analysis comparing LA with OA in Malaysian children, and the results show that LA can be safely recommended for complicated appendicitis in children in the local setting. Though the operating time was a little longer for LA than OA, both wound infection incidence and postoperative hospital stay were significantly less for LA. There was no evidence of any increase in the intraperitoneal infective complications following LA, as suggested in some of the previous reports. Further prospective, randomised studies are required to assess the role of LA in children. The patients need to be matched for variables, such as the severity of appendicular pathology, surgeon's experience and related factors such as the patient size.

REFERENCES

1. Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. J Am Coll Surg 1998; 186:545-53.
2. Aziz O, Athanasiou T, Tekkis PP, et al. Laparoscopic versus open appendectomy in children: a metaanalysis. Ann Surg 2006; 243:17-27.
3. Meguerditchian AN, Prasil P, Cloutier R, et al Laparoscopic appendectomy in children: A favorable alternative in simple and complicated appendicitis. J Pediatr Surg 2002; 37:695-8.
4. Bhatia JY, Pandey K, Rodrigues C, Mehta A, Joshi VR. Postoperative wound infection in patients undergoing coronary artery bypass graft surgery: A prospective study with evaluation of risk factors. Ind J Microbiol 2003; 21:246-51.
5. Banieghbal B, Al-Hindi S, Davies MRQ. Laparoscopic appendectomy with appendix mass in Children. Pediatr Endosurg Innovative Tech 2004; 8:25-30.
6. Rai R, Chui CH, Sai Prasad TR, et al. Perforated appendicitis in children: benefits of early laparoscopic surgery. Ann Acad Med Singapore 2007; 36:277-9.
7. Moberg AC, Berndsen F, Palmquist I, et al Randomized clinical trial of laparoscopic versus open appendicectomy for confirmed appendicitis. Br J Surg 2005; 92:298-304.