Effects and clinical outcomes of laparoscopic appendectomy in young children with complicated appendicitis: a case series

Rasha Kassem, Khalid Shreef, Mohammed Khalifa

Department Pediatric Surgery, Faculty of Medicine, Pediatric Surgery Unit, Zagazig University, Zagazig, Egypt

Correspondence to Rasha Kassem, MD, Department of Pediatric Surgery, Faculty of Medicine, Pediatric Surgery Unit, Zagazig University, Zagazig, 44511, Egypt;
Tel: 00201000089369;
e-mail: rasha_yousof@yahoo.com

Received 2 December 2016
Accepted 21 December 2016

The Egyptian Journal of Surgery
2017, 36:152–155

Background and purpose
Laparoscopic appendectomy for uncomplicated appendicitis is associated with good outcomes but the role of laparoscopy in complicated appendicitis is more controversial because of high incidence of infectious complications. The aim of this current study is to evaluate the efficacy of laparoscopic appendectomy in complicated appendicitis in young children.
Patients and methods
From May 2015 to May 2016 83 patients aged less than 7 years old underwent laparoscopic appendectomy for complicated acute appendicitis. The following variables were analyzed : age, sex, operative findings, operative time, return of bowel function, resumption of oral feeds, length of hospital stay, postoperative complications (ileus, wound infection and intraabdominal abscess).
Results
The mean age of studied cases was 6.3 years. In 81 patients (97.6%) the procedure was completed laparoscopically. Two (2.4%) patients required conversion to open appendectomy. The operative time was 75.5±28.8 minutes. Two patients (4.6%) had post-operative ileus. One patient (1.2%) developed superficial wound infection. Four patients (4.8%) developed intra-abdominal collections. The mean length of hospital stay was 5.3±2.1 days. No mortality was recorded.
Conclusion
Laparoscopic appendectomy can be the first choice for cases of complicated appendicitis in children. It is a feasible, safe procedure and is associated with acceptable post-operative morbidity with rapid recovery and better cosmetic results.

Keywords:
children, complicated appendicitis, laparoscopic appendectomy

Egyptian J Surgery 36:152–155

1110-1121

Introduction

Acute appendicitis is a common disease in children and appendectomy is the most common emergency operation performed in this population. It is generally accepted that younger ages are more susceptible to perforation [1]. The high frequency of perforation is essentially due to recurrent delayed diagnosis in young children because of their inability to communicate and the high rate of benign pediatric digestive disorders [2].

For a long time, open appendectomy (OA) was the conventional procedure for appendicitis but laparoscopic appendectomy (LA) has gained popularity among pediatric surgeons since its introduction in 1992 [3]. Many published series have reported that LA is superior to OA in uncomplicated appendicitis, especially in terms of reduced postoperative pain, short hospital stay, rapid return to physical activity, better cosmetic results, and lesser incidence of wound complications [4–9].

Several studies in the past have assessed the role of laparoscopy in complicated appendicitis but the results are controversial. Moreover, compared with OA, LA needs higher technical skills, longer operative time, and is associated with a higher incidence of intra-abdominal collections [10–13]. More recent studies have reported the safety and feasibility of this procedure in complicated appendicitis, with low incidence of infectious complications [14–16].

The aim of current study was to evaluate the efficacy and the clinical outcomes of LA regarding postoperative morbidity in children less than 7 years of age with complicated appendicitis.

Patients and methods

This study was carried out during the period from May 2015 to May 2016 in three medical institutions (IbnSena Hospital, Kuwait; King Khaled; and King

 DOI: 10.4103/1110-1121.204529

Fahd Hospitals, KSA). The study included 83 patients aged less than 7 years who were admitted to the emergency department and underwent LA for complicated acute appendicitis. Surgical consent was taken from all parents of patients before undergoing LA.

Complicated appendicitis in this study was defined as acute appendicitis in which perforation with purulence or fecalith in the abdominal cavity or an intra-abdominal abscess was needed (Figs. 1 and 2). We identified the complicated cases on the basis of operative findings. Patients with noncomplicated appendicitis and appendiceal masses confirmed on imaging were excluded from the study.

All patients received preoperative intravenous antibiotics (cephalosporin). All cases made LA under general anesthesia, with endotraceal intubation. A Foley catheter and a nasogastric tube were used routinely in all children.

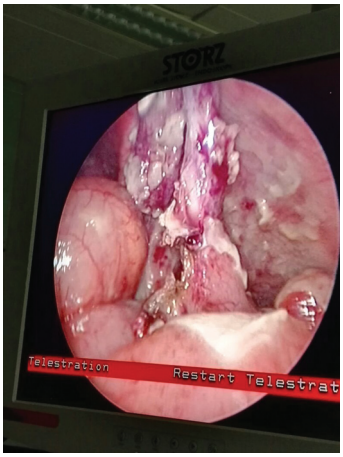
LA was performed using a two-handed, three-trocar technique. The 5 mm umbilical port was introduced using the open technique. The CO_2 insufflation was initiated at a pressure of 8–10 mmHg. Two 5-mm trocars were then placed in the lower-left quadrant and suprapubically under direct vision. The appendix was dissected and the mesoappendix cauterized using a monopolar diathermy attached to either a hook or grasping forceps. The appendicular base was ligated using a pretied handmade Vicryl 2/0 suture in an extracorporeal or polyglactin endoloop. The appendix was divided above the knot and extracted immediately through the umbilical port. Interloop adhesions were released and the pus cavity was drained when encountered. Suction/irrigation was carried out using sufficient saline solution till the aspirate became clear. Closed tube drain was not routinely used and was placed only when deemed necessary. All appendix specimens were sent for histopathological examinations.

After surgery, intravenous antibiotics (cefotaxime 100 mg/kg/24 h and metronidazole 30 mg/kg/24 h) were given. Analgesia was achieved with intravenous/rectal paracetamol for the first and second postoperative days. Oral intake was started as soon as patients could tolerate it and when the bowel function was restored. Patients were discharged after remaining afebrile for 24 h and after they could tolerated normal diet and exhibited a decrease in the white blood cell count to the normal level. The patients were followed up in the outpatient clinic at 1 week, 2 weeks, and at 1 month intervals for 3 months.

Postoperative complications were recorded during hospitalization and the follow-up period. Postoperative ileus was defined as a delay in return of bowel function of more than 48 h. Surgical site infection, erythema, or localized wound collection were treated by antibiotics or surgical drainage. Intra-abdominal collections following appendectomy were diagnosed by using abdominal ultrasound and/or computed tomography. Patients with collections less than 3 cm were managed conservatively with intravenous antibiotics. However, patients with collections more than 3 cm, who did not respond to conservative treatment, were treated by ultrasound-guided aspiration.

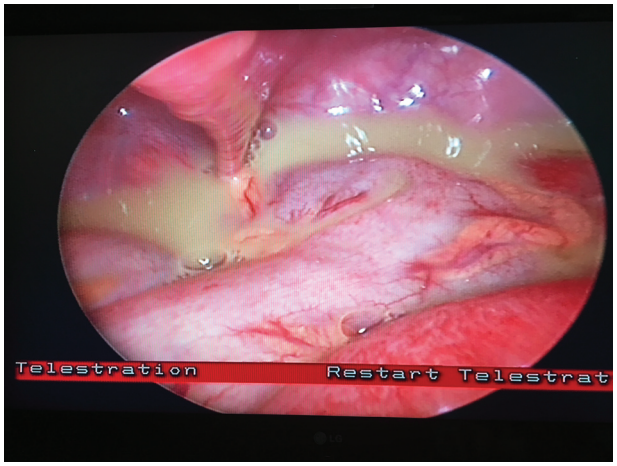
The data were collected, organized, and tabulated, with particular reference to patients' demographics, operative findings, operative time, return of bowel function, resumption of oral feeds, length of hospital

Figure 1



Acute complicated appendicitis with purulence in the peritoneal cavity.

Figure 2



Acute perforated appendicitis.

stay, and postoperative complications (ileus, wound infection, and intra-abdominal abscess).

This study was approved by the ethical committees of the hospitals.

Results

During the period from May 2015 to May 2016, 83 patients with complicated acute appendicitis underwent LA. Thirty-seven (44.5%) patients were girls and 46 (55.4%) were boys. Their ages ranged from 4.5 to 7 years (mean: 6.3 years).

In 81 (97.6%) patients the procedure was completed laparoscopically; however, in two (2.4%) patients, conversion was mandatory because appendices were extremely friable. The operative time was 75.5± 28.8 min. The children were able to resume oral intake within 1.9±0.5 days. Two (4.6%) patients experienced postoperative ileus.

One (1.2%) patient developed superficial wound infection, which was treated conservatively with dressing and antibiotics. Four (4.8%) patients developed intra-abdominal collections, less than 3 cm, and were treated successfully with intravenous antibiotics only (third-generation cephalosporin).

Three (3.6%) patients were readmitted because of recurrent abdominal pain. No relevant cause was detected and they were discharged and followed up in the outpatient clinic. All were doing well with no more symptoms.

The mean length of hospital stay was 5.3±2.1 days. No mortality was recorded.

Discussion

Some studies suggested a lack of good evidence supporting laparoscopic approach for complicated appendicitis [10–13]. However, others concluded that LA for complicated appendicitis is better than is open OA [14–17]. Hypothetically, in complicated appendicitis, especially in obese children, LA can benefit a patient compared with OA because it minimizes the tissues trauma, allows better visualization of abdominal spaces and meticulous peritoneal irrigation, avoids wound incision and extension, and is associated with less exposure of wound surface area to contaminated fluids. Taking in consideration the above-mentioned debate, the aim of our study was to evaluate the efficacy of LA in children with complicated appendicitis in our institutions.

In their study, Wang *et al.* [14] reported that the operative time in LA is significantly longer than that in OA. This longer duration is due to the fact that the manipulation of inflamed tissues with laparoscopic instruments is more difficult, making the dissection slower, to avoid the risk of visceral injury [14].

The mean operative time in our study was 75.5± 28.8 min. Other studies have reported a longer or shorter operative time [17–19]. This difference could be attributed to the difference in the level of laparoscopist's skills.

In this study, the conversion rate was 2.4%, which nearly matches that reported in other studies [20]. On the other hand, Vahdad *et al.* [21] observed a higher conversion rate (24%), whereas Wang *et al.* [14] reported no conversion in their study. We believe that the surgeon's experience plays an important role in determining the rate of conversion.

Our patients were able to start oral intake within 1.9±0.5 days, and stayed in hospital for 5.3±2.1 days. These results are in agreement with the results of Wang *et al.* [14] – in their study the duration of restarting oral intake was 1.8±0.6 days and the length hospital stay was 6.5±2.2 days.

Several studies have shown that younger-aged children with appendicitis usually have higher rates of perforation and greater risk for developing complications because of delayed diagnosis [22]. This could be explained by the fact that many nonsurgical conditions such as constipation, gastroenteritis, and mesenteric adenitis may mimic appendicitis, as well as the lack of verbal communication skills [2].

Many studies found that LA markedly reduced the postoperative wound infection rate when compared with OA (1.3 vs. 12.5%) [14,16,21]. The rate of wound infection in our study was 1.2%. This low rate of postoperative wound infection could be explained by fact that in LA the incisions are small and limited to the trocar entry sites and the perforated appendix is extracted within a retrieval bag.

There is always a concern about the high risk for postoperative intra-abdominal collection in complicated appendicitis. In our study, the postoperative intra-abdominal collection was observed in four (4.8%) patients. Menezes *et al.* [23] published a retrospective study of 118 children with complicated appendicitis: they stated that the incidence of intra-abdominal collection in LA was lower than that in OA (5.5 and

7.8%, respectively). Similarly, Kwok *et al.* [24] found a similar incidence (5.7 vs. 4.3%). This may be due to the fact that laparoscopy gives the surgeon the privilege to explore the whole intra-abdominal recesses and to aspirate any visible collection.

Conclusion

LA can be the first choice for cases of complicated appendicitis in young children. It is a feasible and safe procedure. LA is associated with acceptable postoperative morbidity, with rapid recovery and better cosmetic results.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Bansal S, Banever G, Karrer FM, Partrick DA. Appendicitis in children less than 5 years old: influence of age on presentation and outcome. Am J Surg 2012; 204:1031–1035.

2 Masoomi H, Mills S, Dolich MO, *et al.* Comparison of outcomes of laparoscopic versus open appendectomy in children: data from the Nationwide Inpatient Sample (NIS), 2006–2008. World J Surg 2012; 8:573–578.

3 Ure BM, Spangenberger W, Hebebrand D, Eypasch EP, Troidl H. Laparoscopic surgery in children and adolescents with suspected appendicitis: results of medical technology assessment. Eur J Pediatr Surg 1992; 2:336–340.

4 Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. J Am Coll Surg 1998; 186:545–553.

5 Milewczyk M, Michalik M, Ciesielski M. A prospective, randomized, unicenter study comparing laparoscopic and open treatments of acute appendicitis. Surg Endosc 2003; 17:1023–1028.

6 Guller U, Hervey S, Purves H, Muhlbaier LH, Peterson ED, Eubanks S, Pietrobon R. Laparoscopic versus open appendectomy: outcomes comparison based on a large administrative database. Ann Surg 2004; 239:43–52.

7 Nguyen NT, Zainabadi K, Mavandadi S, Paya M, Stevens CM, Root J, Wilson SE. Trends in utilization and outcomes of laparoscopic versus open appendectomy. Am J Surg 2004; 188:813–820.

8 Katkhouda N, Mason RJ, Towfigh S, Gevorgyan A, Essani R. Laparoscopic versus open appendectomy: a prospective randomized double-blind study. Ann Surg 2005; 242:439–448.

9 Faiz O, Blackburn SC, Clark J, Bottle A, Curry JI, Farrands P, Aylin P. Laparoscopic and conventional appendicectomy in children: outcomes in English hospitals between 1996 and 2006. Pediatr Surg Int 2008; 24: 1223–1227.

10 Horwitz JR, Custer MD, May BH, Mehall JR, Lally KP. Should laparoscopic appendectomy be avoided for complicated appendicitis in children? J Pediatr Surg 1997; 32:1601–1603.

11 Bonanni F, Reed J 3rd, Hartzell G, Trostle D, Boorse R, Gittleman M, Cole A. Laparoscopic versus conventional appendectomy. J Am Coll Surg 1994; 179:273–278.

12 Martin LC, Puente I, Sosa JL, Bassin A, Breslaw R, McKenney MG, *et al.* Open versus laparoscopic appendectomy. A prospective randomized comparison. Ann Surg 1995; 222:256–261.

13 Krisher SL, Browne A, Dibbins A, Tkacz N, Curci M. Intra-abdominal abscess after laparoscopic appendectomy for perforated appendicitis. Arch Surg 2001; 136:438–441.

14 Wang X, Zhang W, Yang X, Shao J, Zhou X, Yuan J. Complicated appendicitis in children: is laparoscopic appendectomy appropriate? A comparative study with the open appendectomy – our experience. J Pediatr Surg 2009; 44:1924–1927.

15 Tashiro J, Einstein SA, Perez EA, Bronson SN, Lasko DS, Sola JE. Hospital preference of laparoscopic versus open appendectomy: effects on outcomes in simple and complicated appendicitis. J Pediatr Surg 2016; 52:804–809.

16 Horvath P, Lange J, Bachmann R, Struller F, Königsrainer A, Zdichavsky M. Comparison of clinical outcome of laparoscopic versus open appendectomy for complicated appendicitis. Surg Endosc 2016; 31:199–205.

17 Yau KK, Siu WT, Tang CN, Yang GP, Li MK. Laparoscopic versus open appendectomy for complicated appendicitis. J Am Coll Surg 2007; 205: 60–65.

18 Leily Mohajerzadeh L, Rouzrokh M, Tabari AK. Laparoscopic appendectomy in complicated appendicitis of children. Ann Colorectal Res 2014; 2:e16599.

19 Marzouk M, Khater M, Elsadek M, Abdelmoghny A. Laparoscopic versus open appendectomy: a prospective comparative study of 227 patients. Surg Endosc 2003; 17:721–724.

20 Li X, Zhang J, Sang L, Zhang W, Chu Z, Li X, Liu Y. Laparoscopic versus conventional appendectomy – a meta-analysis of randomized controlled trials. BMC Gastroenterol 2010; 10:129.

21 Vahdad MR, Troebs R, Nissen M, Burkhardt LB, Hardwig S, Cernaianu G. Laparoscopic appendectomy for perforated appendicitis in children has complication rates comparable with those of open appendectomy. J Pediatr Surg 2013; 48:555–561.

22 Bonadio W, Peloquin P, Brazg J, Scheinbach I, Saunders J, Okpalaji C, Homel P. Appendicitis in preschool aged children: regression analysis of factors associated with perforation outcome. J Pediatr Surg 2015; 50: 1569–1573.

23 Menezes M, Das L, Alagtal M, Haroun J, Puri P. Laparoscopic appendectomy is recommended for the treatment of complicated appendicitis in children. Pediatr Surg Int 2008; 24:303–305.

24 Kwork KY, Wing TS, Chun NT, Li MK. Laparoscopic versus open appendectomy for complicated appendicitis. J Am Coll Surg 2007; 205:60–66.