

Laparoscopic surgery treatment of children with appendiceal abscess

Y.-Y. YIN, H.-W. ZHANG, H. CAO, H.-X. ZOU, B.-B. ZHUO, Y. LI, X. ZHANG

Department of General Surgery, Xuzhou Children's Hospital, Xuzhou, Jiangsu, China

Abstract. – OBJECTIVE: To evaluate the feasibility of treatment for children with appendiceal abscess by laparoscopic surgery and investigate its superiorities to conventional treatments.

PATIENTS AND METHODS: 45 children with appendiceal abscess who were treated with laparoscopic surgery from January 2011 to July 2011 were reviewed and analyzed. The age of children ranged from 7 months to 5 years. 37 children received emergency operations, among which 8 children additionally received laparoscopic surgery. 40 children received laparotomy for treatment of appendiceal abscess, and 28 children whose condition was ameliorated after the conservative anti-inflammatory treatment received laparoscopic surgery.

RESULTS: Operations of 45 children were successful, and lasted for 35 to 130 minutes with an average time of 75 minutes. There was no obvious difference in comparison of duration of laparotomy between the two groups ($p > 0.05$). But the laparoscopy resulted in fewer complications than the laparotomy with a statistical significance difference ($p < 0.05$). Moreover, the operation time for laparoscopy was shorter than that of laparotomy, but the difference in incidence rates of complications after the operation had no statistical significance ($p > 0.05$). The overall length of stay was apparently prolonged in two groups with a statistically significant difference ($p < 0.05$).

CONCLUSIONS: If the operation and perioperative period are handled properly, treating children with appendiceal abscess by laparoscopic surgery is safe and feasible.

Key Words:

Laparoscopic surgery, Laparotomy, Children.

although there remain some controversies about laparoscopic surgery of children's complex appendicitis, many reports hold positive attitude towards the operation effect. From January 2011 to July 2011, a total of 45 children with appendiceal abscess received laparoscopic surgery, and the effect was satisfactory.

Patients and Methods

Patients

A group of 45 children (28 boys and 17 girls) who were in first onset of this disease at the age of 7 months to 5 years (a median age of 3 years and 2 months). The onset of symptoms lasted for 3 to 10 days before the admit to the hospital. Examinations were carried out when they calmed down, an enclosed mass located in right lower abdomen could be felt by suppression, and the abdominal ultrasound examinations suggested periappendiceal abscess. Emergency operation was carried out for 37 children after admittance to the hospital, among which 8 children additionally received laparoscopic surgery because no efficacy was shown in 12 to 24 hours after conservative treatment. Forty children who underwent laparotomy for appendiceal abscess and 28 children who underwent selective laparoscopy after anti-inflammatory conservative treatment were enrolled in this study as control groups, and their perioperative and postoperative complications were compared. This study was approved by the Ethics Committee of Xuzhou Children's Hospital. Signed written informed consents were obtained from the patients' guardians.

Operation Method

Preoperative Preparation

Patients were not allowed to eat anything after they were admitted to the hospital and were given

Introduction

Epityphlon is one of the common acute abdominal diseases in pediatric surgery. Without timely diagnosis and treatment, they often suffer from periappendiceal abscess. In recent years,

third generation cephalosporin and flagyl. Based on their overall condition, children received fluid infusion and glycerin enema an hour before operation to defecate.

Operation Process

Operation was performed with tracheal intubation under general anesthesia and retention catheterization before operation. Children were in supine position with their body being raised up by placing something under their waist. Umbilical scar was opened through a lengthwise incision of 5 mm to expand the umbilical ring. Peritoneum was incised and puncture with 5 mm Trocar was performed under direct vision. Then the Trocar was fixated, and CO₂ pneumoperitoneum was established with a pressure between 10 and 12 mmHg, and a laparoscope was inserted at 30°. Puncture with 5 mm Trocar through left lower quadrant and pubis was carried out under direct vision respectively. Intestinal tube was separated from abdominal wall and omentum majus with suction apparatus or curved forceps and oozed fester was all absorbed at any time to prevent the infection from spreading. Cecum was gradually exposed, and epityphlon was freed. A hole was made in appendix root mesoappendix, and 4# line was then used to litigate appendix root and mesoappendix under the guidance. The mesoappendix was cut off along the epityphlon's surface and the remote part of epityphlon was litigated using Endoloop. After epityphlon was cut off, 10 mm Trocar was placed on the pubic bone incision to remove the epityphlon and take out tissue blocks for culture and drug sensitivity test. The children's position was adjusted, head up and foot down, and body tilted rightwards. Enterocoeleia was rinsed with normal saline, during which pelvic cavity or interintestinal abscess that existed in hypogastric bowls should be separated gradually, and pus should be aspirated totally to maximally reduce the incidence rate of residual infection. The drainage tube was placed on the pelvic floor and was guided out through pubic bone incision, and then pneumoperitoneum was released. Trocar was removed and drainage tube was fixed.

Postoperative Management

Anti-inflammatory treatment using Imipenem and Cilastatin Sodium was performed for children with severe systemic infections or white blood cell count exceeding $30.0 \times 10^9/L$, while the rest still received the antibiotic combination which was same to that before operation. Anti-

biotics were duly adjusted after the culture and drug sensitivity test. Children were not allowed to eat anything for 2 to 3 days after the operation, and then they could eat liquid or semi-liquid foods. The dressing of the incision needed to be changed every other day, and abdominal cavity drainage tube was set for 2 to 4 days.

Statistical Analysis

SPSS 13.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis and the means were shown by $(\bar{x} \pm s)$. In comparisons, we applied the χ^2 -test or exact probabilities in fourfold table. A difference of $p < 0.05$ was considered statistically significant.

Results

Forty-five children underwent successful operation which took 35 to 130 min (the average time was 75 min) and the length of stay was from 5 to 11 days (average of 7.5 days). Rectal distention stimulation occurred in 2 children and they were diagnosed as pelvic abscess by ultrasound B examination. They were cured by drainage through puncture under ultrasonic location. Pubic bone incision infection was seen in 3 children and they were cured through fresh dressing and physiotherapy. One infant suffered from intestinal obstruction in a month after the operation, and the infant got recovered after experiencing fasting, gastrointestinal decompression, and coloclyster. Compared with those children who underwent laparotomy, there was no statistically significant difference between the two groups in comparison of operation time ($p > 0.05$). Those children who underwent laparoscopic surgery had comparatively lower occurrence rate of complications after operation, and the difference had a statistical significance ($p < 0.05$) (Table I).

Some children with appendiceal abscess were treated with anti-inflammatory drugs, conservative methods and received laparoscopic appendectomy surgery. A total of 28 children were selected as control group, and the operation was carried out by the same surgery team. We found that the occurrence rate of complications after comparison had no obvious significance ($p > 0.05$), although the latter took less time than the former. But overall length of stay was apparently prolonged, and the difference between the two groups had statistical significance ($p < 0.05$) (Table II).

Table I. Comparison of perioperative condition and comparison of postoperative complications of children between the laparoscopy group and the laparotomy group ($\bar{x} \pm s$).

Groups	Cases	Operation duration (min)	First defecation time (h)	Complications		
				Incision infection	Residual infection	Adhesive ileus
Laparoscopic surgery	45	70.5 ± 15.2	22.4 ± 6.8	3	2	1
Laparotomy	40	66.7 ± 10.9	41.9 ± 15.3	8	6	3
<i>p</i>		> 0.05	< 0.05	< 0.05	< 0.05	< 0.05

The cases of adhesive ileus after six months' follow-up visit.

Discussion

Children with appendicitis do not have typical clinical manifestations, lack self-reported symptoms, and are afraid of body examination, so the rate of misdiagnosis, missed diagnosis and perforation is much higher¹⁻³. Therefore, children in this age group, especially rural children have suffered the perforation and developed the focal abscess before they have been transferred to specialized hospital, which will have a side-effect on the following treatment. But diagnosis is not difficult, instead abdomen ultrasound and right lower-abdominal mass could be simultaneously used for identification, and the important point is to guarantee the proper treatment^[4-7]. We previously chose anti-inflammatory conservative treatment, and operated on patients in a given time after they recovered and were discharged from the hospital. However, in these two times of hospital stays, length of stay or total hospitalization expenses are longer or higher than that of operation after immediate admittance to the hospital. There is no difference in complications after operation, which to some

extent indicates the feasibility of operation during the acute appendicitis abscess stage. At present, controversies still exist about whether it is appropriate to treat these children with laparoscopic surgery or not, but it has been recognized by many scholars in recent years⁸⁻¹¹. But with the improvement in children' laparoscopic surgery techniques and the development of newborn' laparoscopic surgery, it is feasible to treat these children with periappendiceal abscess. The operation time for laparoscopic surgery is somewhat longer than the laparotomy, but it has many advantages such as location of epityphlon, managing abscess and rinsing local parts of enterocoelia^[12-15]. Thus, infection rates in the incisions and focal abdomen after operation and the incidence rate of adhesive intestinal obstruction are relatively lower compared to control group. Consequently, duration of antibiotics is shorter and it will be helpful for recuperation after operation.

At the same time, surgeons are confronted with the particularity of this operation. (1) The narrowness of enterocoelia: as children are still in this special developmental stage of infancy or childhood, the volume of their enterocoelia

Table II. Comparison of perioperative condition and comparison of postoperative complications of children between the laparoscopy group and the selective laparoscopy group ($\bar{x} \pm s$).

Groups	Cases	Operation duration (min)	First defecation time (h) [▲]	Complications		
				Incision infection	Residual infection	Adhesive ileus [*]
Laparoscopic surgery selective	45	75.0 ± 15.2	7.5 ± 2.3	3	2	1
Laparoscopic surgery	28	48.3 ± 7.6	17.4 ± 4.9	2	1	1
<i>p</i>		< 0.05	< 0.05	> 0.05	> 0.05	> 0.05

[▲]The length of stay of selective laparoscopic surgery was the total of these two lengths of stay; ^{*}The cases of adhesive ileus after six months' follow-up visit.

is small and the operation under the microscope is difficult^[15]. Therefore, it is very important to use glycerine enema to defecate and for retention of catheterization before operation. Surgeons should try their best to enlarge the abdominal operation space, and adjust according to children positions, which will be helpful for dealing with epityphlon and mesentery. (2) As in children at this age the development of omentum majus is not so good and they have a bad omentum, abdominal wall, terminal ileum and the wrapping of colon could easily become appendiceal abscess. Since children have only some symptoms, and the cohesion is not very strong, it is easier to perform blunt dissection. But if the children have suffered from this disease for more than one week and are still not treated properly, the cohesion between intestinal canal and the abdominal wall is very strong, and the separation and exposure of epityphlon is difficult^[16]. Therefore, it is necessary to be closer to the lateral abdominal wall and the surface of epityphlon when separating or exposing epityphlon so as not to injury intestinal canal or the pelvic organs. (3) Abdominal infection is more pervasive. Encapsulated abscess is already formed around the epityphlon during the operation in these children, and it could be seen that the pelvic cavity, subhepatic region and space between guts is diffusely festered. Therefore, for children whose abdominal infection is more diffuse, a good cleansing is very important. After the epityphlon has been taken out, the position of the children is changed with their head up and foot down and slanting rightwards. Doctors then repeatedly wash it with normal saline until the drainage liquid becomes clear and simultaneously 0.2% metronidazole is used to wash enterocoelia. The abdominal cavity drainage tube is placed on the pubic bone incision to reduce the abdominal residual infection.

Conclusions

If the operation and perioperative period are handled properly, it is feasible that children with appendiceal abscess can receive laparoscopic surgery. This method has some advantages compared to the conventional laparotomy and conservative way of undergoing an operation in a given time.

Conflict of Interest

The Authors declare that they have no conflict of interests.

References

- 1) ERGAZ Z, SIMANOVSKY N, VROMEN A, MEIR K, BAR-OZ B. Amyand's hernia with perforated appendicitis in a premature infant. *Eur J Pediatr* 2014; 173: 541-543.
- 2) BAYRAKTUTAN U, ORAL A, KANTARCI M, DEMIR M, OGUL H, YALCIN A, KAYA I, SALMAN AB, YIGITER M, OKUR A. Diagnostic performance of diffusion-weighted MR imaging in detecting acute appendicitis in children: comparison with conventional MRI and surgical findings. *J Magn Reson Imaging* 2014; 39: 1518-1524.
- 3) WU YF, ZHENG YP, ZHANG N, LIU H, ZHENG QX, YANG FT, WU YF. Study on the correlation between the changes in intra-abdominal pressure and renal functional in the patients with abdominal compartment syndrome. *Eur Rev Med Pharmacol Sci* 2015; 19: 3682-3687.
- 4) CHEONG LH, EMIL S. Determinants of appendicitis outcomes in Canadian children. *J Pediatr Surg* 2014; 49: 777-781.
- 5) ABBASI N, PATENAUDE V, ABENHAIM HA. Evaluation of obstetrical and fetal outcomes in pregnancies complicated by acute appendicitis. *Arch Gynecol Obstet* 2014; 290: 661-667.
- 6) JACKSON HT, MONGODIN EF, DAVENPORT KP, FRASER CM, SANDLER AD, ZEICHNER SL. Culture-independent evaluation of the appendix and rectum microbiomes in children with and without appendicitis. *PLoS One* 2014; 9: e95414.
- 7) SHAH S, MOREIRA A. Sterile cerebrospinal fluid pleocytosis in an infant with appendicitis. *Clin Pediatr (Phila)* 2013; 52: 1070-1071.
- 8) IKEDA H, ISHIMARU Y, TAKAYASU H, OKAMURA K, KISAKI Y, FUJINO J. Laparoscopic versus open appendectomy in children with uncomplicated and complicated appendicitis. *J Pediatr Surg* 2004; 39: 1680-1685.
- 9) 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.
- 10) 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.
- 11) GOH BK, CHUI CH, YAP TL, LOW Y, LAMA TK, ALKOUDEER G, PRASAD S, JACOBSEN AS. Is early laparoscopic appendectomy feasible in children with acute appendicitis presenting with an appendiceal mass? A prospective study. *J Pediatr Surg* 2005; 40: 1134-1137.

- 12) HU JF, WU JY, ZHANG L, YANG LG, LONG CX. Diagnostic value of high mobility group box 1 for acute appendicitis in children. *Zhongguo Dang Dai Er Ke Za Zhi* 2014; 16: 919-921.
- 13) BRISIGHELLI G, MORANDI A, PAROLINI F, LEVA E. Appendicitis in a 14-month-old infant with respiratory symptoms. *Afr J Paediatr Surg* 2012; 9: 148-151.
- 14) KOKHANOVSKY N, NACHTIGAL A, REINDORP N, ZEINA AR. Ultrasonography diagnosis of acute appendicitis in a 6 month old infant coexisting with ileal obstruction: caused by an omental band. *Isr Med Assoc J* 2012; 14: 776-777.
- 15) SHEN Z, ZHENG S. Timely recognition of Amyand's hernia with appendicitis in infants. *World J Pediatr* 2015; 11: 392-394.
- 16) OZAO-CHOY J, KIM U, VIEUX U, MENES TS. Incidental findings on computed tomography scans for acute appendicitis: prevalence, costs, and outcome. *Am Surg* 2011; 77: 1502-1509.