Pediatric Anesthesia and Critical Care Journal 2024;12(1):38-45
doi:10.14587/paccj.2024.6

PACCJ

In the treatment of complication of Crohn's disease, advantages of mini-invasive technology

M.U. Ismayilov [1], R. Sh Polukhov[1], I.V. Poddubny[2], V.A. Magammedov[1]

Department of Pediatric Surgery, Azerbaijan Medical University[1]. Evdokimov Moscow State Medical and Dental University[2]. Baku, Azerbaijan.

Corresponding author: M. U. Ismayilov, Department of Pediatric Surgery, Azerbaijan Medical University.
Email: uismayilli@gmail.com

Keypoints

Endosurgical technology is less traumatic and is accompanied by less blood loss, significantly reducing the duration of intensive care in a specialized department, the severity of postoperative pain, the earlier start of enteral load, and faster recovery of peristalsis.

Abstract

The article analyzed the anamnesis data of 93 children with Crohn's disease who were treated from 2010 to 2022. All children with Crohn's disease underwent a comprehensive examination at the stage of identifying and confirming the disease in the hospital, as well as during the differential diagnosis of Crohn's disease and ulcerative colitis. In addition, when planning to perform abdominal surgery, it is important to know exactly the nature, extent, severity, gravity, and location of damage to the intestine and abdominal cavity, if possible. Analyzing our experience of treating 93 children with KX using laparoscopic (in 62 patients) and "open" methods (in 31 children), we can come to the following conclusions. The technique of laparoscopic resection of various parts of the small and large intestines developed and applied in our clinic is an effective treatment method for this serious disease. In no aspect, its universality, convenience, radicality, etc. it does not lag "open" operations.

Keywords

Crohns disease (CD), laparoscopy, cicatricial stenosis, ileocecal resection, ileoassendo anastomosis, ileotransverse anastomosis.

Introduction

Crohn's disease (CHD) is a granulomatous, non-specific chronic inflammation of the intestines, that damages the entire gastrointestinal tract, from the oral cavity to the rectum, and causes perforation, scar stenosis, etc., leading to several complications [1,2,3]. An important task before surgical treatment of Crohn's disease is comprehensive preoperative preparation and assessment of all risk factors for surgical complications by a multidisciplinary team [4,5]. CD causes chronic anemia, hypoalbuminemia, and chronic bacterial inflammation, which reduces physical development and quality of life. At the same time, Statistical analysis shows significant improvement in weight-height, laboratory, and endoscopic parameters after two-stage surgical treatment [6]. The mortality rate during open and laparoscopic operations of CD in children is the same. However, open surgery differs from patients undergoing laparoscopic procedures with higher morbidity, including respiratory complications, surgical complications, need for blood transfusions, and increased medication use. In some patients, laparoscopy is safer, more efficient, and has fewer complications [7,8].

In recent years, the application of laparoscopic interventions as a minimally invasive surgical method in the treatment of CD has begun to be widely used due to the good cosmetic effect, quick recovery of intestinal function, and reduction of the length of stay in the clinic. Although complications such as adhesion-induced intestinal obstruction and wound infection are significantly reduced during these interventions, the frequency of postoperative relapses does not differ significantly compared to open surgeries. In recent years, laparoscopic interventions have become the "gold standard" in the treatment of such serious diseases [9,10,11].

Ileocecal resection is the most commonly performed operation in Crohn's disease. When comparing the laparoscopic-assisted and open methods, the endosurgical approach should be considered the method of choice, because it has a shorter hospital stay and a lower risk of complications during the 30-day postoperative period [12].

Laparoscopic colectomy for Crohn's disease in pediatric patients is safe and associated with shorter hospital stays and equivalent hospital costs than the open procedure. Socioeconomic disparities in laparoscopic use exist and warrant further investigation [13].

Material and methods

The main clinical group (group 1) included 62 children (boys - 24 (38.7%), girls - 38 (61.3%)) who underwent mini-invasive laparoscopic operations with the methodology developed in the clinic during abdominal complications of Crohn's disease. Comparative group 2 in our study included 31 patients (11 boys (35.5%), 20 girls (64.5%)) due to Crohn's disease. For them, surgical treatment of complications using previously accepted common "open" surgical methods, extensive laparotomy approaches - classic emergency and planned operations - intestinal resection, stoma placement, abdominal cavity rehabilitation, drainage, etc. All patients underwent the following examinations: Standard general clinical, biochemical and other tests, assessment and correction of nutritional status of patients, calprotectin test, test for Cl Difficile toxins, decontamination before surgery if detected, study of markers of inflammatory reaction, abdominal cavity, pelvis, retroperitoneal area, etc., o including a comprehensive ultrasound examination of the assessment of the degree of inflammation in the intestinal wall and abdominal cavity, a complex of endoscopic examinations - FEQDS, ileocolonoscopy, multiple mandatory repeat biopsies and further morphological studies, video capsule studies - strictly according to the instructions, always after excluding areas of the intestine that are sensitive to narrowing x-ray contrast examinations of all levels of the gastrointestinal tract are carried out. CT and MR enterography, - are performed in all children and evaluate the state of the intestines and abdominal cavity, identify areas of inflammation, narrowing, scar strictures on the intestinal wall, etc., are highly effective methods for determining. When statistically analyzing research results when processing quantitative indicators, the W (Wilcoxon-Mann-Whitney) test was used. When analyzing qualitative indicators, the method used was Pearson's X^2 test (chi-square) (when $n \geq 5$) and Fisher's exact test (when $n < 5$). Statistical studies were carried out using MS EXCEL and S-PLUS programs. The following operations were performed in children with KX (62 people - group 1A).

- emergency laparoscopic surgery – performed in 4 children. Temporary separation of the most damaged parts of the intestine, healing, and drainage of abscesses, abdominal cavity (2 patients), ileocecal resection, placement of ileostomy (2 patients), (figure 1).

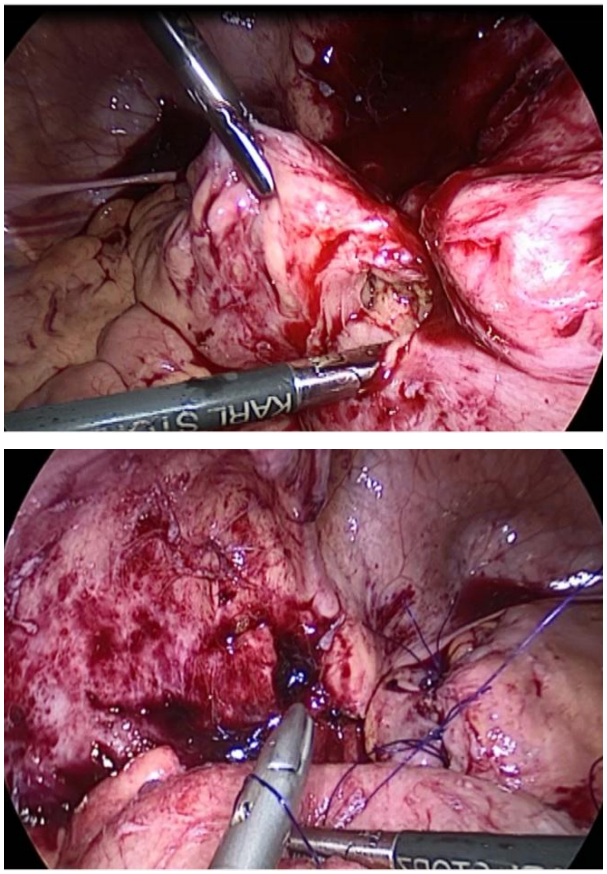

Figure 1. The abscess was separated, the fistula was repaired with double sutures.

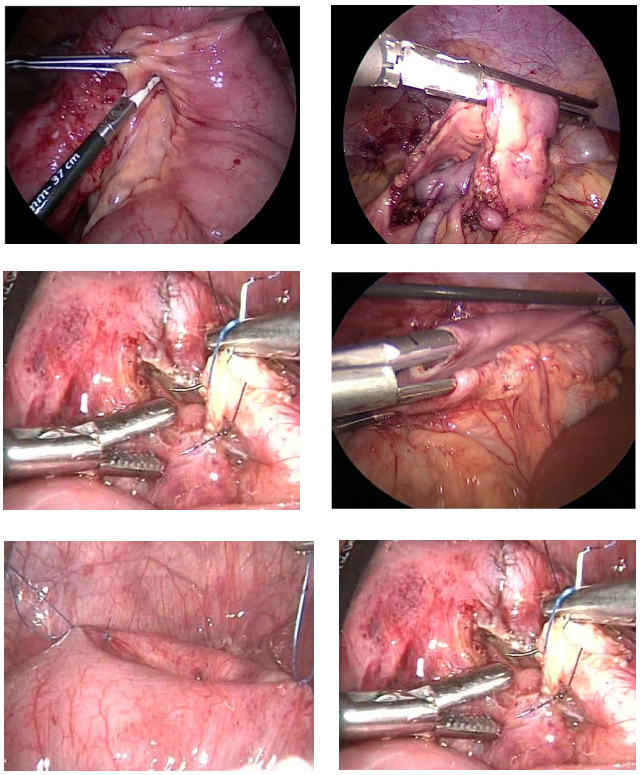

Figure 2. Intestinal mobilization, resection, placement of guide sutures, placement of a linear stapler device, sewing of "technological holes".

- Planned laparoscopic operations were performed in 58 children - resection of intestinal areas where the formation of irreversible inflammatory-scarring changes leading to the formation of the structure was determined:
  - in the ileocecal region – 43 (74.1%). (figure 2)
  - in the proximal parts of the small intestine – 9 (15.6%)
  - in the large intestine -6(10.3%) (figure 3)

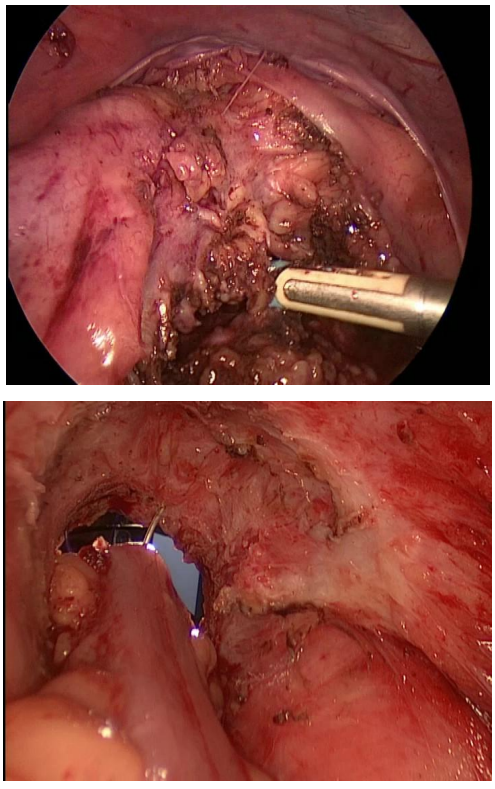

Figure 3. Separation of the rectum, lower colorectal anastomosis

Operations performed according to the localization of the stricture were as follows:

- laparoscopic ileocecal resection, "side-to-side" ileoassendo or ileotransverso anastomosis by means of an intracorporeal apparatus - 43 patients (picture 1);
- laparoscopic segmental resection of the small intestine, intracorporeal "side-by-side" small-small-bowel anastomosis - 9 patients;
- laparoscopic rectal resection and manual lower coloanal anastomosis (when the stricture is located at the level of the rectal and sigmoid colon) – 2 patients;
- laparoscopic subtotal proctocolectomy performed with preservation of the blind and ascending colon, its 1800 turning and lowering through the right lateral canal, placement of very low colorectal anastomosis, and ileostomy (in case of stenosis of the anus, transverse colon, and stricture of the left half of the large intestine) – 1 patient;
- laparoscopic segmental resection during isolated narrowing of the transverse colon, application of "side by side" large-large intestinal anastomosis by means of intracorporeal apparatus - 3 patients;
- laparoscopic segmental resection of the small intestine, intracorporeal "side-by-side" small-small-bowel anastomosis - 9 patients;
- laparoscopic rectal resection and manual lower coloanal anastomosis (when the stricture is located at the level of the rectal and sigmoid colon) – 2 patients;
- laparoscopic subtotal proctocolectomy performed with preservation of the blind and ascending colon, its 180^0 turning and lowering through the right lateral canal, placement of a very low colorectal anastomosis and ileostomy (in case of stenosis of the anus, transverse colon and stricture of the left half of the large intestine) – 1 patient.
- laparoscopic segmental resection during isolated narrowing of the transverse colon, application of "side by side" large-large intestinal anastomosis by means of intracorporeal apparatus - 3 patients.

In children with KX (31 people - group 2A), the following operations were performed by the "open" method.

- Emergency laparoscopic surgery was performed in 3 children. Stoma with temporary separation of the most damaged parts of the intestine, rehabilitation and drainage of abscesses, abdominal cavity (2 patients), ileocecal resection and placement of ileostomy (1 patient);
- Planned laparoscopic operations were performed in 28 children - resection of intestinal areas where the formation of irreversible inflammatory-scar - scar changes that led to the formation of the structure was determined:
    - in the ileocecal region – 25 (89.3%)
    - in the proximal parts of the small intestine – 2 (7.1%)
    - in large intestine – 1 (3.6%).
- Operations performed according to the localization of the stricture were as follows:
- ileocecal resection, "side-to-side" ileoassendo or ileotransverse anastomosis - 20 patients;
- ileocecal resection, ileoassendo or ileotransverse anastomosis by "Vitebsk" method - 5 patients
- segmental resection of the small intestine, "side-by-side" small-small-bowel anastomosis - 2 patients;
- segmental resection during isolated narrowing of the transverse colon, application of "side by side" large-large intestinal anastomosis - 1 patient.

Discussion

The examined patients were aged from 18 to 39 years. The average age of pregnant women in the main group, 27.98±5.3 years, did not differ from that in the comparison group - 27.65±4.2 years and in the control group - 27.91±6.8 years ($p>0.05$) (Table 1).

Comparative analysis of the results of treatment of children with inflammatory bowel diseases in the main (laparoscopic) and comparative groups. In order to evaluate the effectiveness of treatment, the following intraoperative and postoperative indicators were analyzed:

- the duration of the surgical operation, the volume of intraoperative blood loss, the frequency and severity of intraoperative complications, the need and frequency of conversion (for laparoscopic operations), the necessity and duration of the stay in the intensive care unit (ICU), the time for normalization of body temperature, painkillers (narcotic, non- drugs, etc.) need and duration of use, need, and duration of stimulation of the intestines with drugs, as well as time for recovery of intestinal peristalsis, time of patient activation, length of stay of the patient in the hospital after surgery, frequency and severity of early and late postoperative complications, related to complications the frequency of repeated surgical operations, the functional and cosmetic results of the treatment in the near and long term, the quality of life of the operated patients.

Intraoperative indicators characterizing laparoscopic and "open" operations performed on our patients are presented in the tables (Tables 1,2,3).

Benchmarks to be compared	Main group 1A, n=62	Comparison group 2A, n=31	P
Operation duration (min.)	125,1±4,3 (95-260)	118,9±7,4 (85-250)	p<0,05
Volume of intraoperative blood loss (ml)	155,6±1,1(141-170)	309,3±3,7(280-340)	p<0,001
Length of stay in intensive care unit (days)	2,74±0,10 (2-4)	5,84±0,27 (4-8)	p<0,001
Time for normalization of body temperature (days)	4,11±0,11 (3-5)	6,90±0,17 (5-8)	p<0,005
Duration of use of painkillers (days)	3,89±0,13 (2-5)	6,19±0,14 (4-7)	p<0,001
Duration of drug stimulation of the intestines (days)	3,92±0,11 (3-5)	6,68±0,21 (4-8)	p<0,001
Time to start enteral loading after surgery (hours)	14,60±0,25 (12-18)	35,52±1,33 (24-48)	p<0,001
Time to appearance of loose stools (days)	2,61±0,09 (2-4)	5,48±0,18 (3-7)	p<0,001
Bed days of the patient in the hospital after surgery	5,84±0,24 (3-9)	14,19±0,49 (9-18)	p<0,001

Table 1. Comparison of intraoperative parameters in patients in the main 1A and comparative 2A groups of children with CD

The results of treatment of patients admitted with complications of Crohn's disease are always in focus. The comparison of the conducted studies shows that there is a significant difference in the volume of blood loss, which is the main influence on the quality of the operation (p<0.001). Thus, blood loss during laparoscopic operations was 156 ml on average, and 309 ml during the "open" method. The duration of operation is shorter in laparoscopic operations (109.4±2.1 86-139) compared to "open" method (128.3±3.2 96-158) (p<0.001). This number decreases due to the development of technological tools and the increase in the experience of the surgeon performing the operation. Blood transfusion may be necessary in every operation, especially in such severe operations. During the course of these operations, 2 (3.23%) patients in the laparoscopic method and 3 (9.68%) patients in the "open" method needed blood transfusion (PEFM = 0.2). A comparison of other indicators shows that laparoscopic operations are significantly superior. There was no need for conversion in this complex patient population.

We used the above classification (based on the Clavien–Dindo scale) to assess the severity of early postoperative complications.

Groups of CD patients	Group 1A, n=62		Group 2A, n=31		P
	definitely.	%	definitely.	%	
Grade 1 (prevented wound infection)	2	3,2	3	9,7	P_{EFM}>0,05
Grade 2 (adjunctive drug therapy and other therapies)	2	3,2	2	6,5	P_{EFM}>0,05
Grade 3a – interventions without general anesthesia	2	3,2	2	6,5	P_{EFM}>0,05
Level 3b–interventions under general anesthesia	1	1,6	2	6,5	P_{EFM}>0,05
Grade 4 – additional treatment of complications in the intensive care unit	1	1,6	1	3,2	P_{EFM}>0,05
Grade 5 – patient death.	0	0,0	0	0,0	–
Total early postoperative complications	8	12,9	10	32,3	p<0,02

Table 2. Grade of early postoperative complications in patients with KX according to the Clavien–Dindo scale (in groups 1A and 2A)

The total number of early postoperative complications was significantly different. Thus, 8 (12.9%) patients in the laparoscopic method and 10 (32.3%) patients in the "open" method had complications of various degrees ($p<0.02$). No significant difference was found when comparing other indicators.

The long-term results of the treatment were evaluated not earlier than 12 months after the operation. The number and nature of late postoperative complications and required reoperations were analyzed.

Groups of CD patients	Group 1 (laparoskopik), n=62	Group 2 ("açıq"), n=31
The total number of delayed postoperative complications requiring repeat surgical interventions	3 (4,8%)	2 (6,5%)
Type of complications		
Delayed bowel obstruction	–	–
Intraperitoneal infiltrate, fistula	1	1
A new localization of intestinal stricture	2	1
Uncontrolled perianal dermatitis requiring a temporary ileostomy	–	–

Table 3. Delayed postoperative complications requiring repeated surgical interventions

Results

1. Laparoscopic operations are an effective and safe treatment method that allows performing resections of various segments of the small or large intestine with the application of intra-intestinal anastomosis in almost all clinical situations, in emergency indications and in a planned manner, during complications of patients in complex groups such as Crohn's disease in children.

2. The methods of intestinal resection and formation of inter-intestinal anastomoses (small - small intestine, small-large intestine, ileorectal, colorectal, etc.) by the laparoscopic method proposed in the performed scientific work are linear and circular staplers, manual endoscopic if there is appropriate technical equipment and experience of surgeons. using intestinal sutures can be considered a reliable and safe selection method that can be universally applied to children.

Conclusion

Analyzing our experience of treating 93 children with KX using laparoscopic (in 62 patients) and "open" methods (in 31 children), we can come to the following conclusions. The technique of laparoscopic resection of various parts of the small and large intestine developed and applied in our clinic is an effective treatment method for this serious disease. In no aspect, its universality, convenience, radicality, etc. it does not lag behind "open" operations in terms of;

- The method of forming a wide inter-intestinal "side-to-side" anastomosis (functionally "end-to-end") according to the described method using a combined technique (suture machine + manual suture):
- it is a universal method for connecting the ends of the intestine after resection (ileocecal, small, large intestine);
- is a reliable method of anastomosis, even in a group of severe patients such as children with KX, the probability of anastomotic failure is minimal;
- forming a wide side-to-side anastomosis is one of the ways to prevent stenosis because such anastomoses are less sensitive to narrowing than end-to-end circular anastomoses;
- such operations can and should be performed in clinics with sufficient experience in performing laparoscopic operations on the intestine, with all the necessary equipment, instruments, devices and consumables, as well as with the participation of specialists in related specialties who are usually involved in the monitoring and treatment of such diseases.
- When conducting a comparative analysis of the use of laparoscopic and "open" methods for intestinal resection during KX in children, it can be concluded that endoscopic interventions:
- it is less traumatic and is accompanied by less blood loss;

- significantly reduces the duration of intensive therapy in a specialized department, the severity of postoperative pain;
- ensures earlier start of enteral load, faster recovery of peristalsis and intestinal passage;
- reduces the time of patients' stay in the hospital, as well as the rehabilitation period of patients in the early and long postoperative periods;
- there is a slight decrease in the number of complications in the early and remote periods after surgery.
-

References

1. Щербакова О.В., Поддубный И.В., Козлов М.Ю. Осложненная болезнь крона у подростков: особенности, показания к хирургическому лечению, трудности перехода во взрослую сеть (обзор литературы) КОЛОПРОКТОЛОГИЯ, 2017, №4. С. 88-98. https://doi.org/10.33878/2073-7556-2017-0-4-88-98. Shcherbakova O.V., Poddubnyy I.V., Kozlov M.YU. Oslozhnennaya bolezn' Krona u podrostkov: osobennosti, pokazaniya k khirurgicheskomu lecheniyu, trudnosti perekhoda vo vzrosluyu zhizn' (obzor literatury) KOLOPROKTOLOGIYA, 2017, № 4. S. 88-98. https://doi.org/10.33878/2073-7556-2017-0-4-88-98
2. Фиокки К. Этиопатогенез воспалительных заболеваний кишечника // К. Фиокки. Перевод с английского языка О.А.Головенко // Koloproktologia. 2015; №1 (51):с.5-20. Fiokki K. Etiopatogenez vospalitel'nykh zabolevaniy kishechnika // K. Fiokki. Perevod s angliyskogo O.A. Golovenko // Koloproktologiya. 2015 g.; № 1 (51): str. 5-20.
3. Pasternak G, Chrzanowski G, Aebisher D. Crohn's Disease: Basic Characteristics of the Disease, Diagnostic Methods, the Role of Biomarkers, and Analysis of Metalloproteinases: Life (Basel). 2023 Oct 15;13(10):2062. Doi: 10.3390/life13102062.PMID: 37895443.
4. Данилов М.А., Демидова А.А. Послеоперационный болевой синдром у пациентов с болезнью крона // Доказательная гастроэнтерология. 2023. Т. 12. № 1. С. 37-41. Danilov M.A., Demidova A.A. Posleoperatsionnyy bolevoy sindrom u patsiyentov s bolezn'yu krona // Dokazatel'naya gastroenterologiya. 2023. T. 12. № 1. S. 37-41.
5. Wu Q, Wang X, Wu F, Peng D, Wu G, Yang L, Yuan L.Role of a multidisciplinary team (MDT) in the diagnosis, treatment, and outcomes of inflammatory bowel disease: a single Chinese center's experience. Biosci Trends. 2021 Jul 6;15(3):p.171-179. Doi: 10.5582/bst.2021.01174. Epub 2021 Jun 13.PMID: 34121045.
6. Бекин А.С., Дьяконова Е.Ю., Гусев А.А., и др. . Результаты этапного хирургического лечения детей с поражением илеоцекальной области и распространенным активным воспалением при болезни крона / Детская хирургия. 2023. Т. 27. № 2. С. 82-90. Bekin A.S., D'yakonova Ye.YU., Gusev A.A. I dr. Rezul'taty etapnogo khirurgicheskogo lecheniya detey s porazheniyami ileotsekal'noy oblasti I naiboleye aktivnym rekomendatsiyam pri bolezni krona / Detskaya khirurgiya. 2023. T. 27. № 2. S. 82-90.
7. Gilna GP, Saberi RA, O'Neil CF, Ramsey WA, Huerta CT, Langshaw AH, Parreco JP, Sola JE, Thorson CM, Perez EA. Disparities in utilization of laparoscopic colectomies in pediatric Crohn's disease. J Pediatr Surg. 2022 Jun;57(6):p. 1110-1114. Doi: 10.1016/j.jpedsurg.2022.01.030. Epub 2022 Feb 1.PMID: 35232601
8. Quiroz HJ, Perez EA, El Tawil RA, Willobee BA, Galvez-Cabezas K, Ferrantella AR,

Thorson CM, Langshaw AH, Sola JE.Open Versus Laparoscopic Right Hemicolectomies in Pediatric Patients with Crohn's Disease. J. Laparoendosc Adv Surg Tech A. 2020 Jul;30(7):p.820-825. Doi: 10.1089/lap.2019.0814. Epub 2020 Apr 16.PMID: 32301642.

9. Поддубный И.В., Врублевский С.Г., Алиева Э.И., и др. Опыт лапароскопических резекций кишечника у детей с осложненной болезнью крона // Колопроктология. 2016. № S1 (55). С. 102. Poddubnyy I.V., Vrublevskiy S.G., Aliyeva Ye.I. I dr. Opyt laparoskopicheskikh rezektsiy kishechnika u detey s oslozhnennoy bolezn'yu Krona // Koloproktologiya. 2016. № S1 (55). S. 102.
10. Mege D., Panis Y., Laparoscopic surgery for inflammatory bowel disease. Koloproktologia. 2018;(2):p.14-24.
11. Pini-Prato A, Faticato MG, Barabino A, et.al. Minimally invasive surgery for paediatric inflammatory bowel disease: Personal experience and literature review. World J Gastroenterol. 2015 Oct 28;21(40):p.11312-20. Doi: 10.3748/wjg.v21.i40.11312.PMID: 2652513.
12. Dotlacil V, Lerchova T, Coufal S, Kucerova B, Schwarz J, Hradsky O, Skaba R, Rygl M. Comparison of laparoscopic and open ileocecal resection for Crohn's disease in children. Pediatr Surg Int. 2023 Feb 27;39(1):p.140. doi: 10.1007/s00383-023-05419-9.PMID: 36847848.
13. (Gilna GP, Saberi RA, O'Neil CF, Ramsey WA, Huerta CT, Langshaw AH, Parreco JP, Sola JE, Thorson CM, Perez EA.Disparities in utilization of laparoscopic colectomies in pediatric Crohn's disease. J Pediatr Surg. 2022 Jun;57(6):p.1110-1114. Doi: 10.1016/j.jpedsurg.2022.01.030. Epub 2022 Feb 1.PMID: 35232601)