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# POSSIBILITIES OF MINIMALLY INVASIVE TECHNOLOGIES IN THE TREATMENT OF ACUTE SURGICAL DISEASES OF THE ABDOMINAL CAVITY ORGANS IN CHILDREN

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# ВОЗМОЖНОСТИ МАЛОИНВАЗИВНЫХ ТЕХНОЛОГИЙ В ЛЕЧЕНИИ ОСТРЫХ ХИРУРГИЧЕСКИХ ЗАБОЛЕВАНИЙ ОРГАНОВ БРЮШНОЙ ПОЛОСТИ У ДЕТЕЙ

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**Summary.** This article presents the results of therapeutic and diagnostic videolaparoscopy performed on 5,139 children, aged 2 to 17 years, with various pathologies of the abdominal organs. Among these patients, 4,301 had acute appendicitis and its complications, 109 girls had acute pelvic organ pathology, 96 had acute adhesive intestinal obstruction, 47 had intestinal intussusception, 57 had Meckel's diverticulum, 35 had perforation of the stomach and duodenum, 39 had congenital pyloric stenosis, and 438 had strangulated inguinal and inguinoscrotal hernias. Conversion occurred in 192 (5.1%) cases of therapeutic and diagnostic videolaparoscopy. The overall success rate of therapeutic and diagnostic videolaparoscopy was 94.8%, with positive results in these patients.

***Key words**: videolaparoscopy; diagnostics, treatment, acute abdominal pathologies in children.*

**Резюме.** В статье представлены результаты лечебно-диагностической видеолапароскопии у 5139 детей в возрасте от 2 до 17 лет с различной патологией органов брюшной полости. Из числа больных детей у 4301 был острый аппендицит и его осложнения, у 109 девочек – острая патология органов малого таза, у 96 – острая спаечная кишечная непроходимость, у 47 – кишечная инвагинация, у 57 – дивертикул Меккеля, у 35 – перфорация желудка и двенадцатиперстной кишки, у 39 – врожденный пилоростеноз, у 438 – ущемленная паховая и пахово-мошоночная грыжа. При лечебно-диагностической видеолапароскопии конверсия отмечена в 192 (5,1%) случаях. Лечебно-диагностическая видеолапароскопия оказалась эффективной в 5139 (94,8%) случаях, и у этих пациентов получены положительные результаты.

***Ключевые слова:** видеолапароскопия, диагностика, лечение, острая патология органов брюшной полости у детей.*

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**Relevance of the Problem.** Timely diagnosis and treatment of acute surgical diseases of the abdominal cavity in children remain critical challenges in pediatric surgery. Modern technologies, including ultrasound and videolaparoscopy, can prevent diagnostic and treatment errors [1-3]. The active integration of endovideosurgery into clinical practice has raised discussions about potential complications associated with the technology, their frequency, and causes [4, 5]. Developing measures to prevent and address these issues is essential. Experienced specialists in endovideosurgery provide more comprehensive assessments [6, 7]. As A.Yu. Razumovsky, a pioneer in pediatric endovideosurgery, noted: "Everything is complicated until it becomes simple." Thus, issues of timely diagnosis, treatment, and the use of diagnostic videolaparoscopy for acute abdominal diseases in children remain highly relevant [8, 9].

**Materials and Methods.** Between 2012 and 2023, 5,139 children aged 2 to 17 years with various acute abdominal pathologies were treated at the Republican Children's Practical Center for Minimally Invasive and Endovisual Surgery. Diagnosis involved anamnestic, clinical, and laboratory studies, ultrasound examination, and, when necessary, therapeutic and diagnostic videolaparoscopy as a modern minimally invasive technology. Differential diagnosis of acute abdominal syndrome focused on several surgical pathologies, including acute appendicitis, Meckel's diverticulum, congenital pyloric stenosis, strangulated hernias, gastric and duodenal ulcers and perforations, and gynecological issues in girls, such as ovarian cysts, ovarian apoplexy, torsion of fallopian tubes, primary pelvioperitonitis, and congenital genital anomalies. Acute abdominal syndrome must also be differentiated from urinary tract infections and urolithiasis.

Among the 4,301 children with acute abdominal diseases, 109 girls had acute appendicitis and its complications, 96 had acute intestinal obstruction, 47 had intestinal intussusception, 57 had Meckel's diverticulum, 35 had duodenal ulcer perforation, and 39 had congenital pyloric stenosis.

For suspected acute appendicitis, abdominal palpation revealed local pain in the right lower abdomen, passive muscle tension, and a positive Shchetkin-Blumberg sign. Filatov's sign (89.3%), Shchetkin-Blumberg (81.3%), vomiting syndrome (88.6%), and elevated temperature (86%) were key clinical symptoms. Ultrasound criteria for appendicitis included thickened walls of the appendix, a diameter greater than 1 cm, and the presence of fluid in the right lateral canal and pelvic cavity.

For girls, ultrasound also helped diagnose gynecological conditions such as ovarian apoplexy. Clinical signs of ovarian apoplexy include acute lower abdominal pain, nausea, vomiting, weakness, dizziness, cold sweats, and fainting. In cases of significant bleeding, tachycardia, hypotension, and free fluid in the abdomen were noted. Rectal examination sometimes revealed tumor-like formations.

Acute intestinal obstruction was diagnosed based on clinical, X-ray, and ultrasound signs. Videolaparoscopy was used both for diagnosis and to perform adhesiolysis when possible.

**Surgical Procedure.** In patients with suspected acute abdominal pathologies, therapeutic and diagnostic laparoscopy was performed using a Veresh needle to create pneumoperitoneum, followed by a semilunar incision to insert an 11-mm trocar. Additional 5-mm trocars were used for manipulation. After ruling out appendicitis and other intestinal pathologies, the pelvic organs were examined in girls. In cases of acute appendicitis, the appendix was coagulated at the base using a bipolar coagulator, and the appendix was excised using Raeder rings and removed through the trocar (Figure 1).

Complicated Forms of Acute Appendicitis and Appendicular Peritonitis In cases of complicated acute appendicitis and appendicular peritonitis, thorough sanitation and drainage of the abdominal cavity were performed. This approach helped remove purulent masses and prevent potential complications.

In cases of ovarian apoplexy, the initial step was sanitation of the pelvic cavity and removal of accumulated blood. Then, the site of bleeding from the ovary was identified, after which hemostasis was achieved using a bipolar electrode coagulator (Figure 2).

In cases of ovarian cyst torsion, the cyst was grasped with a clamp, elevated, and coagulated at the base using a bipolar electrode coagulator. The cyst was then excised using scissors.

In cases of ovarian torsion with tissue necrosis, a two-step procedure was performed. In the first step, exudates from the pelvic area were cleared, and in the second step, without rotating the ovary,

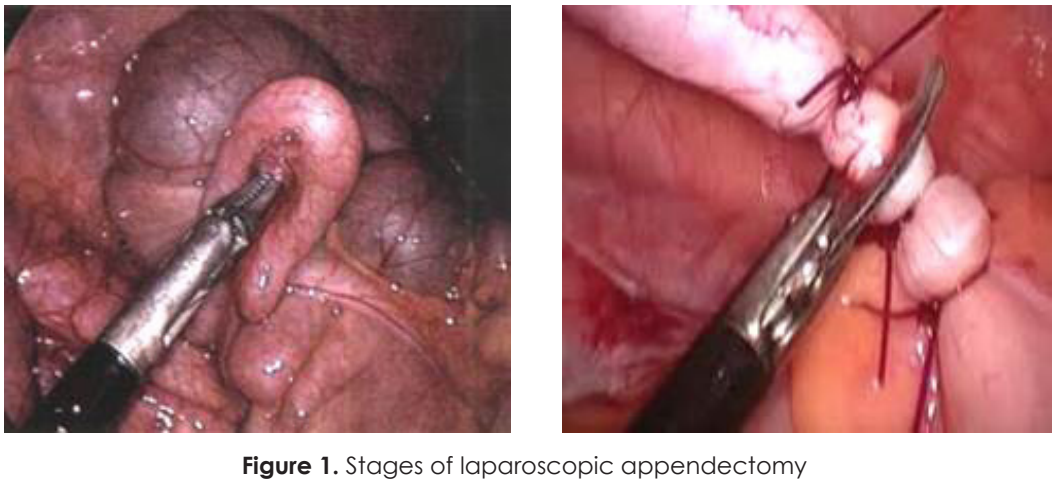


**Figure 1.** Stages of laparoscopic appendectomy

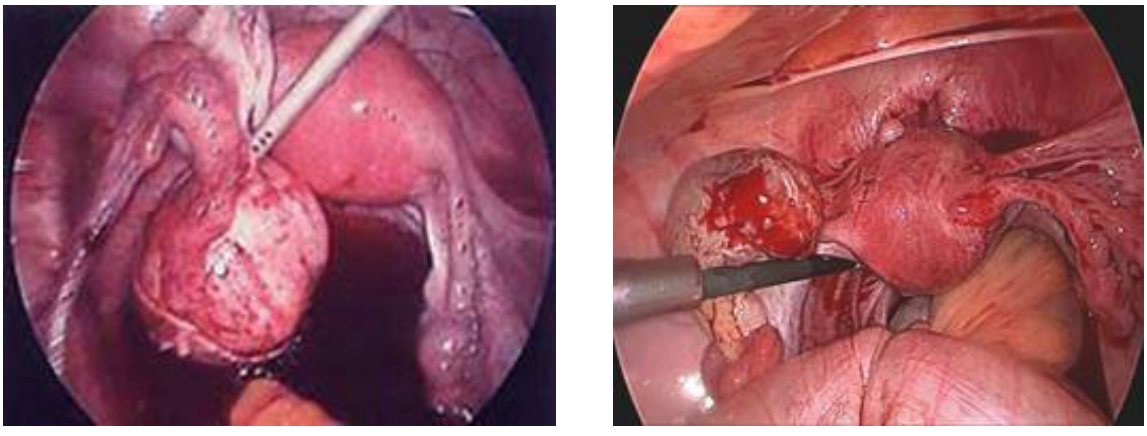


**Figure 2.** Ovarian apoplexy

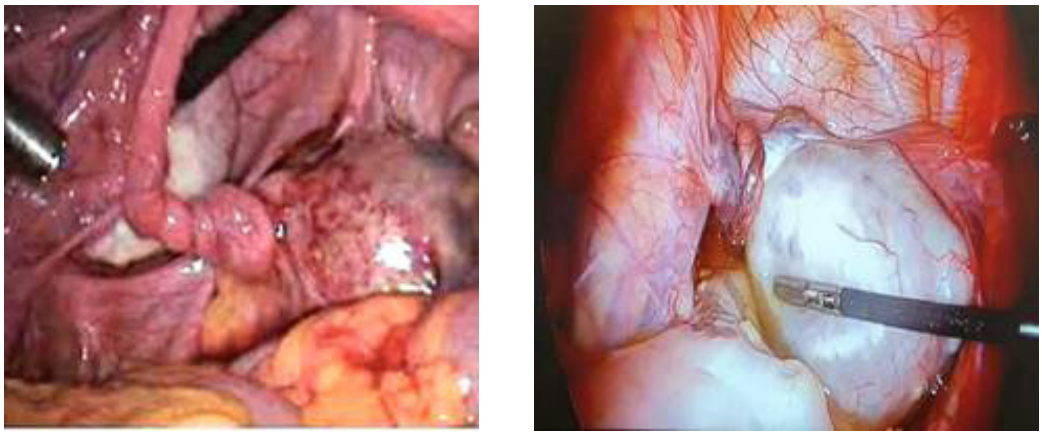


**Figure 3.** Cyst torsion of the fallopian tube

the fallopian tube was ligated using a Raeder ring, if possible, and laparoscopic excision of the ovary was performed. After the procedure, the cavity was treated with a 5% iodine solution. If no tissue necrosis was present, an organ-sparing operation was performed, correcting the position of the ovary and removing the cyst while achieving hemostasis (Figure 3).

In cases of primary and appendicular peritonitis, laparoscopic diagnostic procedures were performed. Samples were taken from the purulent discharge for bacteriological analysis and to assess the extent of infection. The abdominal cavity was thoroughly cleaned using physiological ozone or Decasan solution, and a drain was left in place to ensure further fluid drainage (Figure 4).

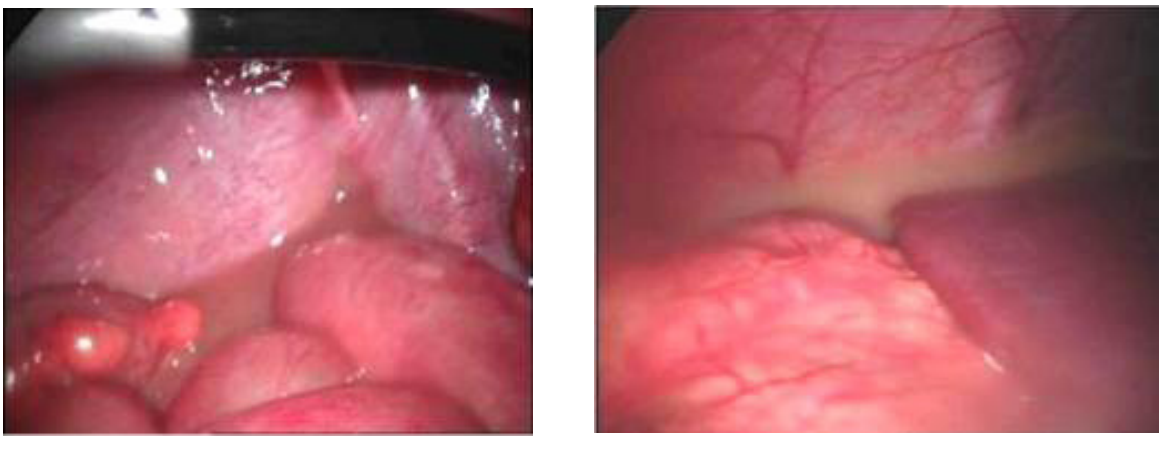


**Figure 4.** Acute appendicular disseminated peritonitis

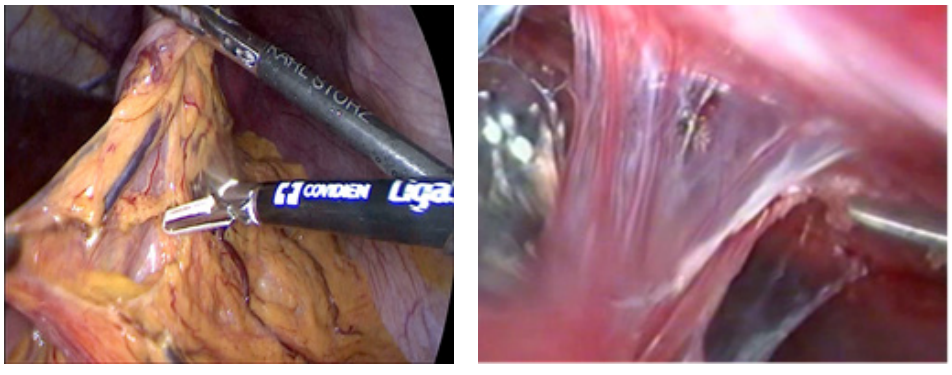


**Figure 5.** Laparoscopic adheziolysis

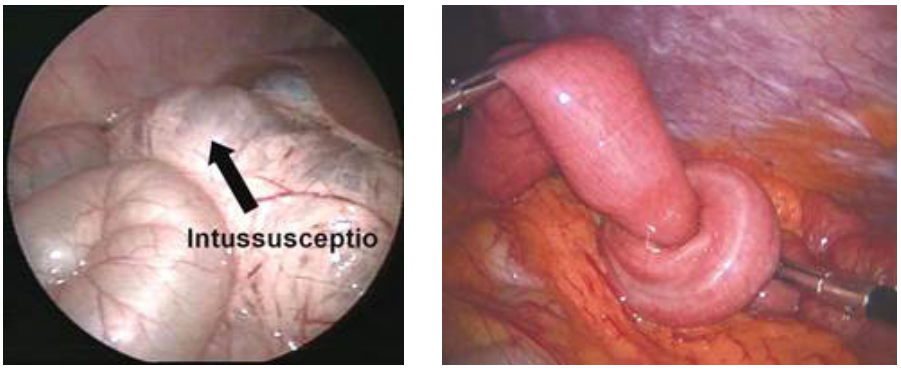



**Figure 6.** Laparoscopic disinvagination

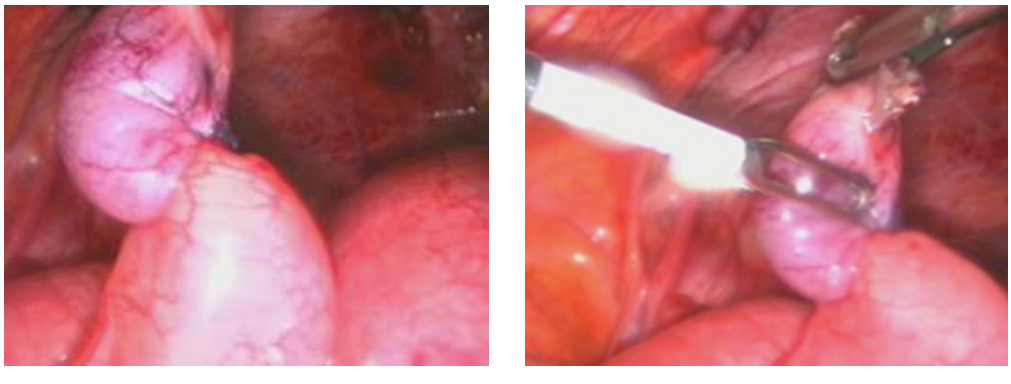
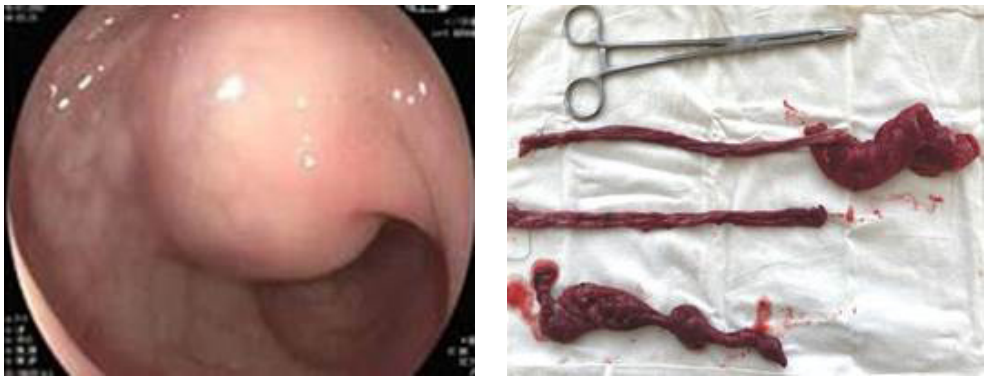


**Figure 7.** Laparoscopic diverticulectomy

In 96 patients with acute intestinal obstruction, diagnostic and therapeutic laparoscopies were performed. An important aspect of treatment was preventive intervention against adhesion formation. During the surgery, special attention was paid to handling the abdominal tissues delicately. A fibrinolytic mixture, including heparin, fibrinolysin, hydrocortisone, gentamicin, and novocaine, was used to prevent adhesions (Figure 5).

In 47 patients with intestinal intussusception, a thorough examination of the condition of the intestines was carried out. Special attention was given to identifying signs of necrosis, the presence of cystic tumors, and the involvement of lymph nodes. In two cases, where irreversible necrotic changes were detected, conversion to open surgery was performed. At the same time, laparoscopic reduction of intussusception was successfully performed in all patients with chronic recurrent intussusception (Figure 6).

During diagnostic laparoscopy, Meckel's diverticulum was identified in 57 patients. In 43 patients with a narrow base of the diverticulum, laparoscopic diverticulectomy was performed using a Raeder ring. In 12 patients with unexplained bleeding and ulcerative diverticulitis, endovideosurgical diverticulectomy with small bowel anastomosis was carried out (Figure 7).



*Nodular shape* *root subtotal form*

**Figure 8.** Congenital hypertrophic pylorostenosis

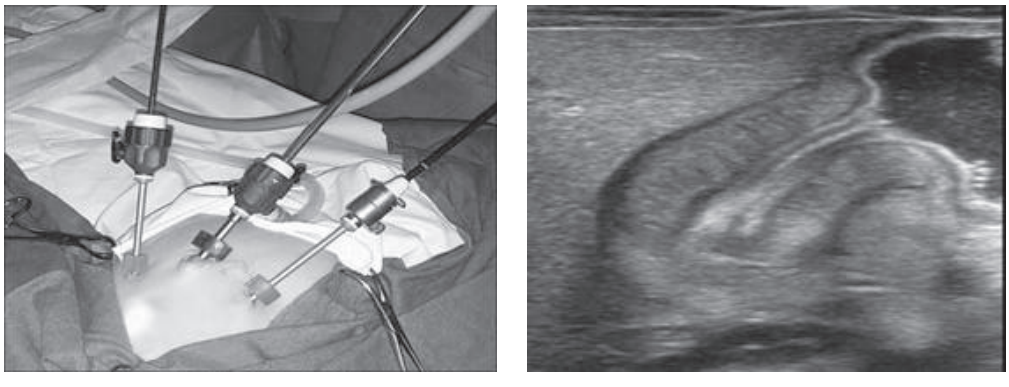


**Figure 9.** Stomach pyloric in UTT examination of laparoscopic pyloromyotomy (intraoperative and external appearance of the child). echocardiogram of the part

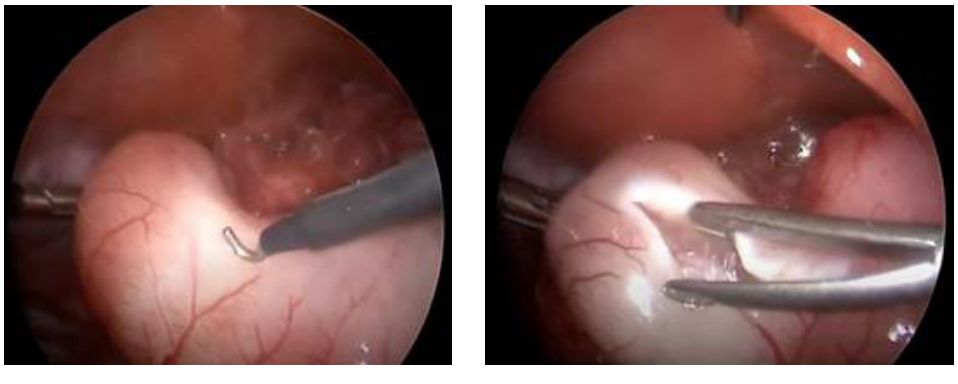


**Figure 10.** Laparoscopic pyloromyotomy (intraoperative view).

In 9 children, duplications of the intestine were diagnosed. In two cases, due to insufficient experience of the surgical team, it was decided to proceed with conversion to open surgery.

39 children with congenital hypertrophic pyloric stenosis were treated, of which 29 were boys and 10 were girls. (Their age ranged from 3 weeks to 5 weeks). The body weight of the operated children ranged from 3600-5200 g. The diagnosis of the disease and clinical symptoms were based on ultrasound data: In this case, the thickness of the pyloric gastric muscle layer was more than 4 mm and the length of the stenotic area was more than 15 mm, and the diameter of the pyloric canal was also assessed (Figure 8, 9).

All children admitted with a diagnosis of congenital hypertrophic pyloric stenosis under-went surgery. Videolaparoscopic pyloromyotomy was performed under endotracheal anesthesia.

Between 2012 and 2023, 438 pediatric patients with a diagnosis of strangulated inguinal and inguinal-diaphragmatic hernias were admitted to the center, aged 1 month to 3 years. The duration

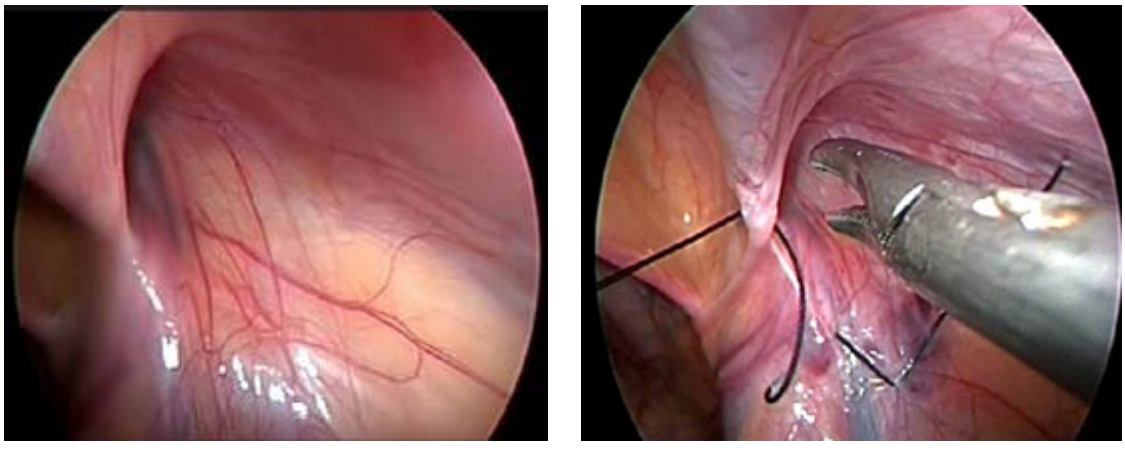


**Figure 11.** Videolaparoscopic hernioplasty

of hernia compression ranged from 1 to 5 hours, with most children having 2 to 3 hours. All patients underwent emergency surgery (Figure 11).

Of these, 234 (53.4%) children underwent surgical removal of a strangulated inguinal hernia using traditional methods, and 204 (46.6%) were children aged 1-3 years, who underwent surgical removal of a hernia using the endovideolaparoscopic method. Necrobiotic irreversible changes in the strangulated areas of the intestine and intestinal loops were not detected in any case. Surgical operations for hernia removal using the endovideolaparoscopic method lasted an average of 20 to 60 minutes. Indications for antibacterial therapy were recommended in the postoperative period if the duration of the disease was more than 3 hours and there was a slight desiccation of the intestinal wall. No complications were observed after the surgical procedures. After the surgical procedure, the general condition of the patient, general blood tests were assessed, and the children were discharged from the hospital on the 3rd-5th day for outpatient treatment.

In all cases, 3-mm trocars and instruments from KARL STORZ were used, and a pylorotomy was used to separate the serous membrane. Then, using endoscopic instruments, the muscularis propria of the pylorus was dissected down to the mucosa. The integrity of the mucosa was monitored by insufflating the stomach and duodenum with air through a nasogastric tube. The duration of the surgical intervention was 15-25 minutes. In 1 (1.6%) case, intraoperative perforation of the pyloric mucosa was observed, which was sutured using video-laparoscopic methods. In the postoperative period, the sick children were treated in the intensive care unit for 2 days. With complete restoration of the gastrointestinal tract, the postoperative period was on the 2nd and 6th days, and the days of hospitalization ranged from 6th to 10th day. All patients who underwent videolaparoscopic pylorotomy had no postoperative complications.

In our clinic, 35 patients aged 12 to 18 years who underwent surgery with a diagnosis of perforation of the stomach and duodenum were studied. Of these, 4 were girls and 31 were boys. All patients

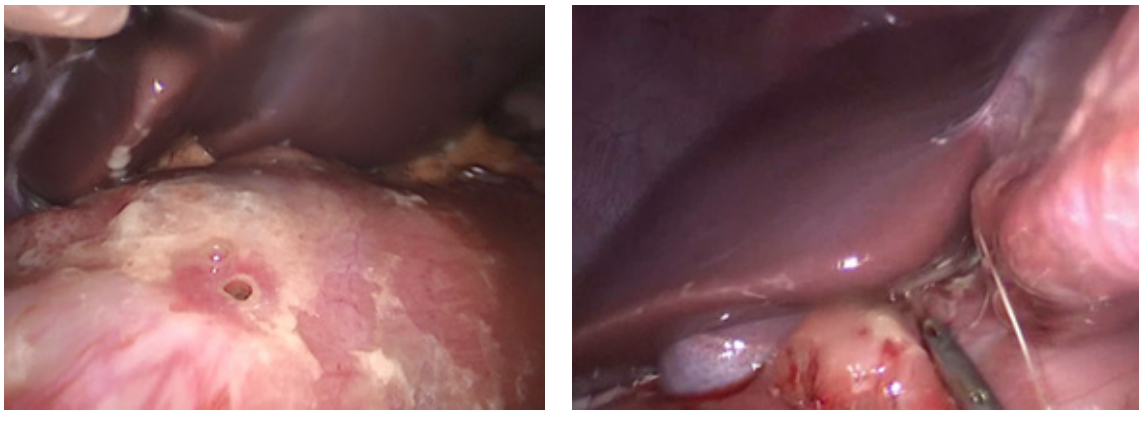


**Figure 12.** Removal of gastric and duodenal ulcer perforation by videolaparoscopic method

were urgently admitted to the surgical intensive care unit for intensive treatment and preoperative preparation after a complete diagnostic examination. Upon admission, the general condition of 32 patients was assessed as moderately severe, and the remaining 3 were in severe condition.

Duodenal perforation was observed in 6 (33.33%) children, and the ulcer was located in the upper part of the duodenum (pars superior). In 7 (38.88%) children, the perforated gastric ulcer was located in the pyloric region of the stomach. Gastric perforation was observed in 5 (27.79%) patients, and the ulcer was mainly located on the anterior surface of the stomach in the greater curvature - in 3 patients and in 2 patients - in the lesser curvature of the stomach. The dimensions of the perforation ulcers were round sclerotic tissue with a diameter of 3 mm to 9 mm. Taking into account the condition of the outer surface of the ulcer, the ulcer edges were not smoothed. Perforated ulcers of the stomach and duodenum were sutured with a double-row suture using a video-laparoscopic method (a nasogastric tube was placed in the stomach and its pyloric section)(Figure 12). Considering the possibility of chemical burns of the peritoneum due to the action of hydrochloric acid and bile with a perforated gastric ulcer and duodenal ulcer in the abdominal cavity, the tactics were as follows. All patients underwent sanitization of the abdominal cavity with 10-12 liters of ozonophytic solution, and a drainage tube was left in the abdominal cavity for monitoring. In the postoperative period, the patients were treated according to standard protocols for gastric and duodenal ulcers. All of them were discharged home from the hospital in a satisfactory condition. No complications were observed in the postoperative period.

**Results and Discussions.** In the study of the results of the diagnosis of acute diseases of the abdominal organs in children, the effectiveness of videolaparoscopy was found to be 100%. The studies conducted show that the conversion from therapeutic and diagnostic videolaparoscopy procedures to192 (5.1%)percent. This is mainly acute adhesive intestinal obstruction and disseminated forms of acute appendicular peritonitis, appendicular abscess, strangulation intestinal obstruction, intussusception with the presence of intestinal necrosis, tumors in the intestinal lumen, perforation of gastric and duodenal ulcers and disseminated peritonitis, as a result of late admission to the hospital for strangulated hiatal hernias with complications, namely intestinal necrosis and resection, laparoscopic operations for congenital pyloric stenosis were performed. After video-laparoscopic interventionsTreatment and diagnostic videolaparoscopy were effective in 3560 (94.8%) cases, and these patients showed positive results.In the study of the results of the treatment of acute diseases of the abdominal organs, no complications requiring reoperation were observed in all patients who underwent videolaparoscopic surgery.

In 1 patient operated on for right ovarian apoplexy and in 2 patients after appendectomy (total 0.8%), postoperative wound suppuration was observed, which was treated with antiseptic agents, and the wound closed secondary. These complications were eliminated using conservative methods, and the result was assessed as satisfactory. In the postoperative period, attention was paid to pain syndrome, patient activity, first independent defecation, early and late postoperative complications. 12-24 hours after videolaparoscopic surgery, 190 (62.3%) children stopped complaining of postoperative pain, and after 24 hours3562 (94.9%)Patients did not complain of pain. Most patients were able to move freely within 8-14 hours. After videolaparoscopic surgery for acute diseases of the abdominal organs, signs of postoperative intestinal paresis were significantly less pronounced, and intestinal motility was restored earlier than usual. In most patients, independent defecation was observed after videolaparoscopic surgery on 1.0 ± 0.5 days. No postoperative intra-abdominal complications were observed. The duration of hospitalization of patients was 3.5 ± 0.75 days. The cosmetic value of the method, especially for girls, cannot be compared even with one or another traditional method.

**Conclusion.**

Thus, the videolaparoscopic method of diagnosing and treating acute surgical diseases of the abdominal organs in children allows for safer and less traumatic surgery in children of all ages. The widespread use of videolaparoscopic technology allows for the prevention of unnecessary surgical interventions performed with a doubtful diagnosis due to the diagnostic stage.The use of endovideolaparoscopic methods in pediatric emergency abdominal surgery improves the quality of diagnosis and treatment, reduces the number of postoperative complications, and also shortens the length of hospital stay. Based on the received scientific and practical conclusions, the use of endovideolaparoscopic methods for acute surgical diseases of the abdominal cavity allows to achieve highly effective results.

## Литература/References

1. Potashov L.V., Vasiliev V.V., Beltyukov P.P., Semenov D.Yu., Osmanov Z.Kh., Orlova O.G. Analysis of the results of the treatment of patients with perforative pylorobulbar lesions with an endovideosurgical method//Collection of abstracts of the International Surgical Congress «Current problems of modern surgery» M – 2003. – S. 29.

2. Sedov V.M., Strijeletsky V.V., Rutenburg G.M., Izbasarov R.J., Luchkin A.N. Endovideosurgery and diagnosis and treatment of diverticula of Mecklenburg // In the materials of scientific-practical conference «Actual issues of diagnosis and surgical treatment of pain in abdominal organs» devoted to 80th anniversary of professor Zemlyanog Anatoliy Grigorevich, SPbMAPO, – St. Petersburg. – 2005. – P. 123–126.

3. Izbasarov R.J., Strijeletsky V.V., Rutenburg G.M., Luchkin A.N. Endovideosurgery and diagnosis of treatment of divertikulum Mekelya // Bulletin of Surgery named after I.I. Grekova. – 2005. – T. 164, – 5. – P. 82–83.

4. Dronov A.F., Poddubnyy I.V., Kotlobovsky V.I. Endoscopic surgery and detail / Under editon of Isakova Yu.F., Dronova A.F. – M.: GEOTAR-MED; 2002. – 440 p (In Russ).]

5. Yartsev P.A., Ermolov A.S., Pakhomova G.V. Laparoscopy and diagnosis of treatment of acute appendicitis // Surgery. Journal named after N.I. Pirogova. – 2010. – No. 4 – S. 21–25.

6. Vrublevsky S.G., Poddubnyy I.V., Trunov V.O., and dr. Urgent abdominal pathology of children of early age // Children's surgery. – 2015. – T.19. – 3. – S. 32–35 (In Russ).]

7. Rentea R.M., Peter S.D., Snyder C.L. Pediatric appendicitis: state of the art review. Pediatric Surg Int. 2017;33(3):269–283. doi: 10.1007/s00383-016-3990-2.

8. Seetahal S.A., Bolorunduro O.B., Sookdeo T.C., et al. Negative appendectomy: a 10-year review of a nationally representative sample. Am J Surg. 2011;201(4):433–437. doi: 10.1016/j.amjsurg.2010.10.009.

9. Jackson H.T, Kane T.D. Advances in minimally invasive surgery of pediatric patients. Adv Pediatrician. 2014;61(1):149–195. doi: 10.1016/j.yapd.2014.03.011.