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Simultaneous Laparoscopic Hernioplasty in Urgent Pediatric Surgery

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ABSTRACT One of the variants of clinical manifestation of Meckel's diverticulum in pediatric patients is intestinal intussusception. In this case, the surgical intervention option may be laparoscopic disinvagination and resection of the diverticulum (if the clinic is equipped accordingly) or video-assisted surgery.

This article presents a clinical observation of the diagnosis and simultaneous treatment of Meckel's diverticulitis complicated by small-colonic intussusception and necrosis of the ileum, secondary appendicitis in combination with bilateral inguinal hernia in a 5-year-old girl. The described observation demonstrates the features of the intraoperative picture and surgical treatment, and describes in detail the effective treatment tactics and the course of surgical intervention.

The described variant of simultaneous treatment of surgical diseases does not affect the course of the surgical period, and also made it possible to avoid repeated intervention (hernioplasty), reduced the anesthetic load (general anesthesia) and neutralized possible surgical stress.

Keywords: Meckel diverticulitis, laparoscopy, hernioplasty, appendectomy, intussusception, anastomosis

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ICA - ileocecal angle
PIRS - Percutaneous Internal Ring Suturing

INTRODUCTION

Currently, the empirical search and further application of less invasive methods of diagnostics and treatment of surgical diseases in the clinical practice of children's hospitals does not lose its relevance [1, 2]. Today, one of the most promising and most accessible methods for a clinician is endovideosurgery (thoracoscopy, laparoscopy) [3]. The widespread introduction of the latter is dictated by a number of undoubted advantages, such as minimal trauma to the tissues of the anterior abdominal wall in comparison with traditional laparotomic approaches, the ability to immediately move from diagnostic measures to surgical ones, as well as prevention of the formation of adhesive processes and a reduction in the recovery period,

early activation of the patient [4-6]. In pediatric abdominal surgery, laparoscopic technologies are actively used in the treatment of acute appendicitis and its complications, adhesive intestinal obstruction and intussusception, which are most typical for pediatric patients [7].

Intestinal intussusception (intestinal intussusception) is one of the most common acute surgical diseases in children requiring emergency surgical intervention [8]. The pathogenesis of intestinal intussusception is based on the discoordination of contraction of the muscle fibers of the intestinal tube, the causes of which can be both alimentary and anatomical (mechanical) reasons, such as polyps, formations or diverticula of the small (Meckel's) or large intestine [9]. Laparoscopic disinvagination has proven itself as a fairly universal technique in the treatment of intestinal intussusception, especially if this is a category of older children, in whom the development of intestinal intussusception may be associated with the manifestation of a congenital malformation of the intestinal tube (often a Meckel's diverticulum) [10].

In addition, it is worth noting that in 20–45% of cases, during urgent videolaparoscopic interventions, concomitant, clinically unmanifested diseases may be diagnosed, requiring repeated surgical intervention for their correction [11]. For example, inguinal hernias (laparoscopy reveals open deep inguinal rings), endovideosurgical treatment of which is recognized as the "gold" standard in children, especially with bilateral localization [12]. Therefore, it seems relevant to describe the clinical experience of using simultaneous hernioplasty during urgent laparoscopy.

The aim of the study was to demonstrate successful experience in treating intestinal intussusception in Meckel's diverticulitis, as well as intraoperatively detected bilateral inguinal hernia in a 5-year-old child.

Clinical observation

A mother with a girl A., 5-year-old, came to the admission department of the Kursk Regional Children's Clinical Hospital (KRCCH) with complaints of moderate pain in the right hypochondrium, loose stools, weakness. According to the mother, the child (girl) had been ill for 24 hours before the visit, when she first developed the above complaints. The dynamics showed an increase in abdominal pain.

On admission, the child's general condition is moderate. The girl is conscious, makes contact, answers questions. The skin is clean, pale pink. Breathing is independent, auscultation is uniform on both sides, wheezing is not heard. Heart sounds are muffled, the rhythm is regular. The abdomen is uniformly distended, participates in the act of breathing, peristalsis is reduced, on palpation it is soft, painful in the area of the right hypochondrium, where a formation up to 5 cm in diameter and up to 10 cm in length is palpated. Appendicular symptoms (Rovsing, Sitkovsky, Bartomier-Michelson) and peritoneal symptoms (Shchetkin-Blumberg, Voskresensky) are negative.

Upon admission, the following instrumental examination methods were performed:

— ultrasound examination of abdominal organs (ultrasound of abdominal organs): in the right hypochondrium a target-type structure measuring 74×40×80 mm is located (Fig. 1A *)* , it is aperistaltic, blood flow in the intestinal walls is preserved, the appendix is determined in the structure of the intussusception, no free fluid is detected. Conclusion: ultrasound signs of intestinal intussusception;

— radiography of abdominal organs in a direct projection in a vertical position: free gas, fluid levels are not determined, the gas bubble of the stomach is large, intestinal pneumatization is increased in the upper half of the abdominal cavity, moderately expressed in the lower (Fig. 1B*)*.

General clinical blood and urine tests did not reveal any significant abnormalities.

Taking into account the complaints, anamnesis data, the child's age, the duration of the disease, the data of the objective examination, laboratory and instrumental studies, a preliminary diagnosis was made: "Intussusception of the intestine. Meckel's diverticulitis?"

A medical council with the involvement of staff from the Department of Pediatric Surgery and Pediatrics of the Kursk State Medical University Institute of Education decided to perform surgical intervention - diagnostic laparoscopy to verify the diagnosis and determine further treatment tactics for the patient.

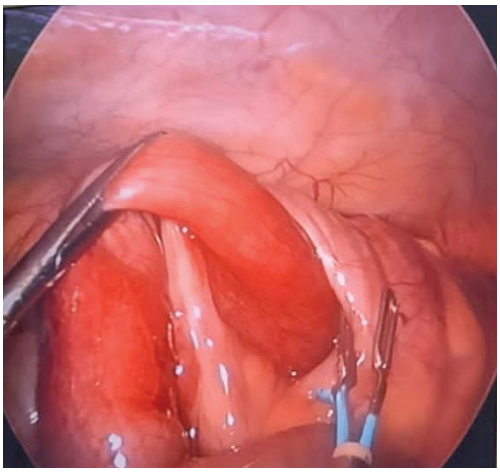
A

IN

Fig. 1. Patient examination data: A — transabdominal ultrasound examination (transverse scan): target-like structure is determined; B — X-ray of abdominal organs in a frontal view, upright position

Diagnostic laparoscopy was performed urgently after preoperative preparation under endotracheal anesthesia. During revision: in the right mesogastric region, a small-large intestinal intussusception up to 5 cm in diameter was determined, in the structure of which was the vermiform appendix; open internal inguinal rings were noted on both sides. Partial disintussusception was performed under visual control using soft endoclamps by means of staged traction — the small-large intestinal part of the intussusception was straightened (Fig. 2A *)* , the small-large intestinal intussusception was preserved (Fig. 2B *)* at a distance of 10 cm from the ileocecal angle (ICA). Further straightening of was not possible without damaging the intestinal wall due to the tight fixation of the intestinal loop trapped in the intussusception. Upon examination of the ICU area, the appendix is injected with vessels, rigid, up to 7 cm long, up to 0.8 cm in diameter.

A



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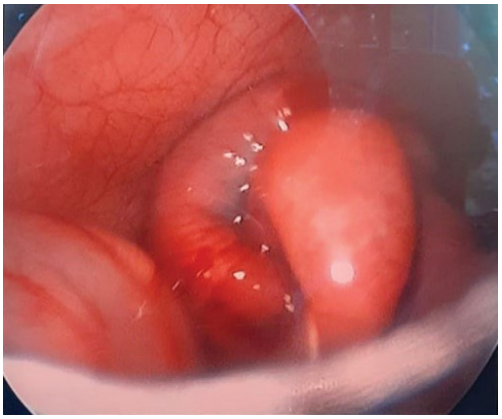
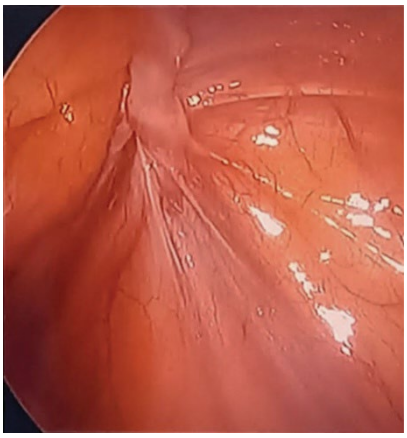


Fig. 2. Intraoperative photo, laparoscopic disinvagination: A — stage of repair of small-large intestinal intussusception; B - small-small intestinal intussusception

Laparoscopic hernioplasty was performed using the *Percutaneous Internal Ring Suturing* (*PIRS*) technique: a *Tuohi* 18 *G needle was inserted into the projection of the deep inguinal ring on the right* , which was passed along its lateral semicircle under the peritoneum, a 2/0 Monofilament thread was inserted through the needle to form a loop. A similar manipulation was performed from the medial side with the introduction of a 2/0 Lavsan thread into the loop, the deep inguinal ring was completely encircled. An extracorporeal knot was formed, which was placed in the subcutaneous tissue. A similar manipulation was performed from the contralateral side (Fig. 3A*)*. After that, taking into account the changes in the appendix (Fig. 3B*)*, a laparoscopic appendectomy was performed with the imposition of two Reder loops on its base.

A



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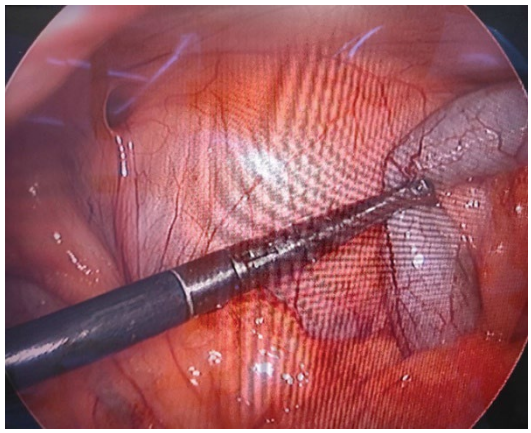

Fig. 3. Intraoperative photo, laparoscopy: A — the inguinal ring is sutured using the PIRS technique; B—the altered appendix in an endoscopic clamps

Upon completion of the laparoscopic part of the surgical intervention, a decision was made to perform a mini-laparotomy for manual disinvagination. The ileal loop withintestinal intussusception was brought down to the right iliac region, where a 3-cm incision was made. The tissues were dissected layer by layer, and access was achieved into the abdominal cavity. The intestinal loop was brought out into the wound, significant changes in the wall of the small intestine were noted, peristalsis was not observed, the wall was dark purple. An attempt at manual disinvagination was unsuccessful, the presence of a Meckel's diverticulum in the structure of the intussusception is likely, preventing its straightening (Fig. 4A*)*. The intraoperative council decided to perform a segmental resection of the ileal section with intestinal intussusception. A resection was performed, a two-

A

IN

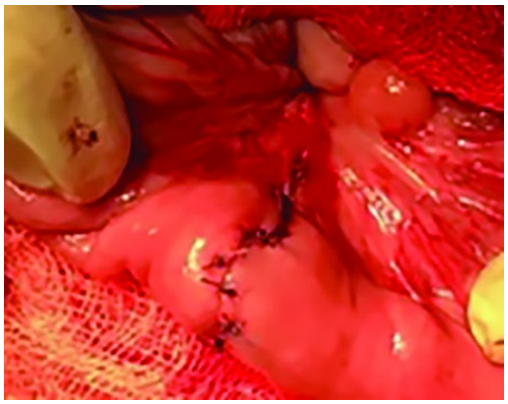

Fig. 4. Intraoperative photo, laparotomy: A — small intestinal intussusception is brought out into the wound; B — anastomosis after resection of the intussusception carrying intestine

layer intestinal anastomosis "end-to-end" (Vicryl 4/0) was applied (Fig. 4B*)*. After that, the intestine was immersed into the abdominal cavity, the mini-laparotomy wound was tightly sutured layer by layer. To continue intensive care, the child was transferred to the anesthesiology and resuscitation department.

On day 4, enteral feeding was initiated, and on day 4 after the operation, after the condition had stabilized, the child was transferred to the surgical department. The postoperative period was uneventful. The child was discharged to the outpatient stage in a satisfactory condition on day 10 after the operation.

Postoperative diagnosis: "Meckel's diverticulitis? Small-colonic intussusception complicated by necrosis of a portion of the ileum. Secondary appendicitis. Bilateral inguinal hernia."

The presence of Meckel's diverticulum in the structure of the intussusception was confirmed by the results of pathomorphological examination.

DISCUSSION

Complications of Meckel's diverticulum are quite common in pediatric practice. The most common variant of clinical manifestation is intestinal obstruction (including intestinal intussusception) [3]. Moreover, this pathology can manifest itself at different periods of a child's life: from infancy to primary or secondary school age [5]. Classic manifestations are cramping abdominal pain, vomiting, stool of the "raspberry jelly" type [6]. Moreover, it is worth considering not only the entire list of these symptoms in each individual patient, but also each one separately [2].

In the presented work, we described a clinical observation of the treatment of a girl with intestinal intussusception, the cause of which was Meckel's diverticulum. Regarding the choice of treatment tactics, we note that given the timing of the disease, as well as the age of the child (based on our own clinical experience, as well as literature data) it is after the neonatal period that intestinal intussusception occurs due to mechanical (anatomical) causes. Therefore, we do not consider it appropriate to increase the period of intestinal strangulation (after the diagnosis is established and before the intussusception is straightened) and expose the child to risk after 12 hours of the disease, performing conservative pneumodesis of intussusception. This was in the described clinical observation.

In addition, an important intraoperative finding is the presence of a bilateral inguinal hernia (open deep inguinal rings); in the present observation, this nosology does not affect the course of the underlying disease. However, repeated surgical treatment (hernioplasty) could be required subsequently. The choice of the *PIRS* technique is due to the availability of the method and its simplicity, as well as according to the technical features of the technique (all manipulations with the thread and needle are carried out mainly subperitoneally, which reduces the risk of ligature infection) [12].

In modern pediatric surgery, the number of simultaneous surgical interventions is increasing to reduce the anesthetic burden on the patient and surgical stress. This has become possible due to endovideosurgical technologies, which expand the possibilities of performing surgical interventions, allowing the operator to choose an appropriate scenario for the course of the operation depending on the clinical situation [13, 14]. However, despite this, the abstract databases contain only a single report on the performance of hernioplasty in pediatric practice during urgent laparoscopy for acute appendicitis [15]. We did not find any other freely available works on the analysis of the possibility of using *PIRS in urgent abdominal surgery.*

CONCLUSION

Currently, a wide range of clinical symptoms and the absence of pathognomonic clinical signs pose a significant challenge in diagnosing abdominal pathology. Due to the widespread introduction of video laparoscopy into surgical practice, surgeons have the opportunity to combine not only diagnostic, aimed at establishing a diagnosis, but also therapeutic manipulations. This allows expanding the surgeons' arsenal with new approaches and methods for performing operations, introducing simultaneous interventions. The described observation presents the experience of treating an inguinal hernia in a girl with intestinal intussusception, which required resection of a section of the ileum. The inclusion of the hernioplasty stage in the course of the surgical intervention did not affect the course of the postoperative period, which allows us to recommend this approach for urgent laparoscopy in children. But this requires a larger evidence base and in-depth study.

REFERENCES

1. Abduvaliyeva CM. Intussusceptional obstruction in children. *World Bulletin of Public Health*. 2023;19:43–46.
2. Rangan V, Lamont JT. Small Bowel diverticulosis: pathogenesis, clinical management, and new concepts. *Curr Gastroenterol Rep*. 2020;22(1):4. PMID: 31940112 https://doi.org/10.1007/s11894-019-0741-2
3. Thanh Xuan N, Huu Son N, Huu Thien H. Treatment outcome of acute intussusception in children under two years of age: a prospective cohort study. *Cureus*. 2020;12(4):e7729. PMID: 32432007 https://doi.org/10.7759/cureus.7729
4. Razin MP, Syrchin EF, Kuznetsov SY, Lobastov DK. Rare Forms of Intussusception. *Russian Journal of Pediatric Surgery, Anesthesia and Intensive Care*. 2015;5(2):79–82. (In Russ.)
5. Yamamoto M, Iwamoto K, Suzuki R, Mukai Y, Takeoka T, Asukai K, et al. Laparoscopic-assisted disinvagination and polypectomy for multiple intussusceptions induced by small intestinal polyps in patients with Peutz-Jeghers syndrome: a case report. *World J Surg Onc*. 2021;19(1):22. PMID: 33478478 https://doi.org/10.1186/s12957-021-02133-5

6. Delibegovich S, Mehmedovic Z. The influence of the different forms of appendix base closure on patient outcome in laparoscopic appendectomy: a randomized trial. *Surg Endosc*. 2018;32(5):2295–2299. PMID: 29098432 https://doi.org/10.1007/s00464-017-5924-z
7. Nissen M, Sander V, Rogge P, Alrefai M, Tröbs RB. Meckel's Diverticulum in Children: a monocentric experience and mini-review of literature. *Children*. 2022;9(1):35. PMID: 35053658 https://doi.org/10.3390/children9010035
8. Barskaya MA, Varlamov AV, Zavyalkin VA, Kuzmin AI, Terekhina MI. Diagnosis and Treatment of Meckel Diverticulum Complications in Children. *Medical & Pharmaceutical Journal Pulse*. 2020;22(12):162–168. https://doi.org/10.26787/nydha-2686-6838-2020-22-12-162-168
9. Redman EP, Mishra PR, Stringer MD. Laparoscopic diverticulectomy or laparoscopic-assisted resection of symptomatic Meckel diverticulum in children? A systematic review. *Pediatr Surg Int*. 2020;36(8):869–874. PMID: 32436063 https://doi.org/10.1007/s00383-020-04673-5
10. Low ZX, Bonney GK, So JBY, Loh DL, Ng JJ. Laparoscopic versus open appendectomy in pediatric patients with complicated appendicitis: a meta-analysis. *Surg Endosc*. 2019;33(12):4066–4077. PMID: 30805783 https://doi.org/10.1007/s00464-019-06709-x
11. Dimitrios G, Vasileios M, Vassilis L, Chrysostomos K, Kleanthis A, Ioannis S. Untypical symptoms for rather uncommon surgical entities: report of two rare cases of secondary intussusception in children (a case report). *Pan Afr Med J*. 2020;37:277. PMID: 33598091 https://doi.org/10.11604/pamj.2020.37.277.26829
12. Huang FH, Cheng PL, Hou WH, Duh YC. Laparoscopic hernia repair with the extraperitoneal approach versus open hernia repair in pediatric inguinal hernia: a systematic review and meta-analysis. *J Clin Med*. 2022;11(2):321. PMID: 35054015 https://doi.org/10.3390/jcm11020321
13. Plut D, Phillips GS, Johnston PR, Lee EY. Practical imaging strategies for intussusception in children. *Am J Roentgenol*. 2020;215(6):1449–1463. PMID: 33084362 https://doi.org/10.2214/AJR.19.22445
14. Tsukamoto R, Sakamoto K, Honjo K, Niwa K, Sugimoto K, Ishiyama S, et al. Case of idiopathic and complete appendiceal intussusception. *Asian J Endosc Surg* . 2018;11(3):256–258. PMID: 29214746 https://doi.org/10.1111/ases.12442
15. Li Y, Guo Z, Qu Z, Rong L, Hong M, Chi S, et al. Laparoscopic simultaneous inguinal hernia repair and appendectomy in children: A multicenter study. *J Pediatr Surg*. 2022;57(8):1480–1485. PMID: 35400489 https://doi.org/10.1016/j.jpedsurg.2022.03.007

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