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## SURGICAL TREATMENT OF APPENDICULAR PERITONITIS IN CHILDREN

### ABSTRACT

The literature review is based on the analysis of sources covering the relevance, etiology, pathogenesis, classification, and modern methods of surgical treatment of appendicular peritonitis in children. The issues for further study of this problem are considered.

In pediatric surgery at the moment there is no single point of view in the treatment of common forms of appendicular peritonitis in children. One of the reasons is the absence of a single criterion for assessing the severity of peritonitis. Each surgeon has his own opinion and measure of evaluation. We believe that assessing the severity of the peritonitis course with scoring and its use in the choice and extent of surgical intervention will reduce the postoperative complication, reduce the number of unreasonable conversions, and, if necessary, give indications for laparotomy and laparostomy. Determination of criteria for assessing the severity of peritonitis is an effective method in the choice of operational tactics for treating peritonitis, which allows to minimize the subjectivism of the surgeon, optimizes the approach to therapeutic tactics in appendicular peritonitis in children.

**Keywords:** appendicular peritonitis in children, literature review.

Appendicular peritonitis is one of the most common severe purulent-inflammatory diseases in children. Operations with acute appendicitis are the most frequently performed emergency operations on the abdominal organs (70%) [10,14, 17], generalized forms of peritonitis with destructive appendicitis in children occur 2.5 times more often, than local ones [14,24].

Despite of the advances in the diagnosis of [3, 10,31] acute appendicitis, the frequency of its destructive forms varies from 20 to 74% [11, 14, 20]. In connection with this, a high incidence of intra-abdominal complications remains from 4.5% to 5.1% [10, 14, 15, 24]. Local purulent-inflammatory complications in acute appendicitis occur in 15.8% of cases [11, 10,26]. Multiple surgical interventions, severe consequences of the disease and unsatisfactory quality of life: a violation of physical, psychological, social and school functioning [18,21] make pediatric surgeons consider the problem open and seek new solutions. The urgency of this problem is also due to the fact that most of the developed complications require a second operation, the danger and traumatism of which is much higher than the primary intervention.

The introduction of the endosurgical method of treatment into practice [13, 15] contributed to the reduction of postoperative complications and improvement of immediate results of treatment. The lethality according to the literature data for appendicular peritonitis in 1972 was 0.48%, in 1981 - 0.42% according to the data of V.A. Popov (1985), and at the age of 3 years it reached 1.2 % according to E.A. Stepanov (1974).

The lack of clear indications for

endoscopic sanitation with diffuse peritonitis in children, algorithms for conversion or program sanitation dictates the need for criteria, objective indications for choosing the method of treatment, and the development of an optimal scheme of antibiotic therapy.

The operations conducted for spilled peritonitis in children are of an acute social nature and are manifested by a decrease in the fertility of girls who underwent operative treatment for peritonitis in childhood [11]. The survey of women operated in childhood showed that 68.9% had menstrual irregularities. V.V.Podkamenov (2002) emphasized that infertility in women with anamnestic appendectomy and inflammatory diseases of the abdominal cavity is 13%. The frequency of adhesions and various forms of intestinal obstruction is great. The use of laparotomy and laparostomy allows solving the main problems, both during the operation and in the postoperative period. First of all, it is an opportunity to conduct a full sanitation of the abdominal cavity with revision of internal organs. A good drainage is created, which makes it possible to reduce intoxication, intra-abdominal pressure decreases and it solves the problem of respiratory failure and avoids pulmonary complications, especially in children.

In the literature, different data for the treatment of children with general peritonitis are given, where endoscopy is used for diagnostic purposes, and removal of the purulent focus is made by laparotomy. Also, various indications for switching to laparotomic access are described. There is no single index for assessing the severity of peritonitis.

In the etiology of peritonitis, the main role is played by the bacterial factor, in

most cases it is the microflora of the intestine, in the overwhelming number it is a gram-negative or mixed flora. The nature and severity of the changes depend on the microbial aggression and association [6]. The nature of microflora often determines the prognosis of the disease, the risk of developing sepsis. The causative agents of peritonitis are most often microorganisms of the gastrointestinal tract. The microflora of the abdominal cavity is usually represented by associations of different *Escherichia coli* strains with cocco flora, *Pseudomonas aeruginosa* or *Klebsiella*, and monocultures of enterobacteria are less common [6]. In the last decade there has been an increase in the number of antibiotic-resistant strains of microorganisms and an increase in their virulence, which significantly complicates and requires correction of antibacterial therapy [5, 7,28].

Successful treatment of patients with peritonitis is possible only if the surgeon has a deep knowledge of the pathophysiological processes taking place in the patient's body, otherwise the highest level of operational and technical skills will not prevent the progression of severe general disorders, and the occurrence of local surgical complications [11].

Conditionally it is distinguished four aspects, which are closely interrelated: -mechanisms of the delimitation of the pathological process in the cavity of the peritoneum; -immunogenesis in peritonitis; - pathogenesis of visceral function impairment; -endotoxiosis in peritonitis. A single entry into the abdominal cavity of the infecting agent, as a rule, does not lead to the development of peritonitis, a long-acting source is needed - an uncontrolled damage of the

hollow organ or a lesion focus.

For the first time Sprengel (1906) and V.F.Voino-Yasenetsky (1943) began to classify peritonitis, they distinguished local and diffuse peritonitis. For the first time, the time factor was taken into consideration by V. Ya. Shlapobersky (1958) in his classification and he singled out the principle of staged development of the process. At the First Congress of Surgeons of the RSFSR in 1958, B.A.Petrov and A.A.Belyaev divided the course of the disease into three stages. The first stage is the stage of maximum manifestation of protective mechanisms, followed by the stage of suppression of protective mechanisms and the third, terminal stage is the depletion of protective forces.

In 1971, K.S.Simonyan (1971) proposed a classification widely known among surgeons. It is based on the principle of the prevalence of inflammation. When determining treatment tactics, assessing the prevalence of the inflammatory process is important. So, the author divides peritonitis into local and widespread. In turn, the local is divided into unlimited and limited. Local unlimited peritonitis is an inflammation of the peritoneum, in which exudate accumulates in no more than one or 2 of 9 anatomical areas of the abdominal cavity without a demarcation inflammatory barrier from the peritoneum and organs. With local limited peritonitis, there is an intraperitoneal separation of the purulent process by a biological obstruction, which is regarded as an abscess of the abdominal cavity. In diffuse peritonitis, exudate accumulates not less than 2 and not more than 5 areas of the abdominal cavity. With general peritonitis, exudate occupies more than 5 anatomical areas of the abdominal cavity. Characterizing the severity of the clinical course of peritonitis, K.S.Simonyan (1971) identifies 3 stages of the course of the disease, using the following features: 1) the reactive stage (the first 24 hours) is characterized by the manifestation of local reactions: a sharp pain syndrome, the tension of the muscles of the anterior abdominal wall, motor excitation of the patient; 2) toxic stage (24-72 hours) - the dominance of common manifestations of the disease over local reactions, which is inherent in severe intoxication; 3) terminal stage (over 72 hours) is characterized by pronounced intoxication at the boundary of reversibility. A similar picture is considered by foreign surgeons as a «septic shock».

According to scientists, participants of the All-Union Conference on Peritonitis,

1979, held at the Institute of Emergency Medicine named after N.V. Sklifosovsky, diffuse (general) peritonitis should be considered peritonitis, occupying more than half the areas of the abdominal cavity, i.e. 5 areas and more.

In pediatric surgery, L.M. Roshal, O.V. Karasev promoted the division of appendicular peritonitis into: free, abscessed, combined forms, and they separately identify total abscessed peritonitis.

In pediatric surgery the issue of operative access is connected with the hospital equipment and the certified personnel. S.Ya. Doletsky preferred laparotomic access in the right iliac region, and median laparotomy was used by authors only in 0.5% of cases of all appendectomies. To this group Doletsky included children with the prescription of the disease for more than 5 days, and with dense fibrin overlay with inter-loop abscesses. Many authors (Tretyakov A.P. and others) consider that with diffuse purulent peritonitis a medial laparotomy access is mandatory. These scientists are based on the fact that it is not always possible to perform an adequate revision of the abdominal cavity from a small incision and only the medial access gives the surgeon the opportunity to diagnose the degree of lesion, to perform a full revision and sanitation of the abdominal cavity [1, 4, 8, 19, 20, 23]. Ya. B. Yudin [27] actively recommends including laparotomy and laparostomy to children's surgery. When using laparostomy, the lethality decreased from 1.7% to 0.2%.

The idea of an «open abdomen» in the treatment of peritonitis belongs to N. Mikulich [30]. The first laparostomy was performed in 1949 by the Soviet surgeon N.S. Makokha [19]. Laparostomy is known in the literature under various names: «open method of treating peritonitis», «open abdomen», «fenestration of the abdominal cavity», «controlled peritoneostomy», etc. The method is based on the repeated programmed thorough sanitation of the abdominal cavity [20].

The nature of pathological changes in the abdominal cavity, the lack of free space due to intestinal insufficiency and the expressed adhesion process, an increase in abnormal intra-abdominal pressure [5] do not technically allow the endoscopic operation. In such situations, only laparostomy can be effective. Its main advantage is the possibility of surgical treatment with the so-called «late» peritonitis [22], which allows to visually control the evolution of the inflammatory

process, the qualitative sanitation of the abdominal cavity and thereby prevents the progression of peritonitis and the formation of intra-abdominal abscesses. At the moment, many authors have proven the effectiveness of laparotomy and laparostomy in the treatment of general appendicular peritonitis in children [9, 26, 27].

Currently, many pediatric surgeons refer to the method of laparostomy very carefully because of the lack of clear indications for it. According to experts, the open abdominal cavity leads to profound disturbances in the water-electrolyte and protein balance. Frequent manipulations with the abdominal organs cause a massive adhesive process, and also lead to the formation of intestinal fistulas [12]. According to L.M.Roshal, massive washing contributes to the receipt of progressive substances in areas with increased resorption (diaphragmatic peritoneum), this increases intoxication, increases the likelihood of «penetration» of the vascular bed of toxins, contributes to the development of DIC syndrome, septic shock and multiple organ failure [16]. A comparative analysis conducted by L.M.Roshal and others showed that in clinics where lavage of the abdominal cavity was not performed during surgery, fewer postoperative complications were obtained.

The use of laparoscopic sanitation of the abdominal cavity before appendectomy with peritonitis [10, 15], allows for direct, non-traumatic and complete removal of pus from the abdominal cavity, which sometimes excludes the need for traumatic laparotomy and facilitates the course of the postoperative period. R.A.Belous (2002) and others, having experience in treating children with appendicular peritonitis, indicate a low traumaticity and high effectiveness of this method [13, 16].

In 1968, the All-Union Conference of Surgeons recommended draining the abdominal cavity in patients with acute appendicitis with delimited abscesses in the abdominal cavity, the inability to completely eliminate the purulent necrotic source, and the unreliable halting of bleeding [14].

Indications for drainage of the abdominal cavity and methods of drainage have their supporters and opponents. In pediatric surgery, the method of draining the pelvis by Generalov is widely used [24, 30]. The method was widely used in almost all clinics and it is the method of completing the operation both after therapeutic laparoscopy and after laparotomy [1]. According to J.J. Clark

(2011), laparoscopic drainage is a safe and effective alternative to laparotomy with intra-abdominal abscesses [29].

The modern stage of the development of surgery is characterized by a significant redistribution of operational activity towards the wider use of endoscopic methods of treatment. The progress of endoscopic surgery is provided by the improvement of fiber-optical and optical techniques, endocoagulation methods, the emergence of new models of special instruments. The results of the use of endoscopic methods of treating peritonitis have shown a number of advantages over laparotomy. Based on extensive clinical experience, many authors have concluded that video laparoscopy is a low-traumatic, highly informative and highly effective method for treating peritonitis in children [25,13].

In the foreign literature of recent years, not all support the endoscopic treatment of peritonitis, but in the domestic literature almost all authors write about the benefits of endoscopy in children with peritonitis. In his doctoral work, V.I.Kotlobovsky (2002) wrote: «If the strength of the damaging active factor on the body is not great, then the body can maintain a satisfactory adaptation. In the case of a significant force and prolonged exposure to time, over-regulation of regulatory systems may occur, which ultimately leads to depletion of the body's defenses, a decrease, or even a breakdown, of its functional capabilities. The impact of considerable strength causes a universal general response of the organism in the form of a syndrome of systemic response. Severe surgical trauma caused by traditional surgical methods of treating peritonitis, in itself, can trigger systemic response mechanisms. The negative effect of surgical stress on the body occurs not only at the time of surgery, it affects the entire postoperative period, it ultimately brings a protracted course of peritonitis.» The authors attribute the advantages of laparoscopic technique to the performance of diagnostic laparoscopy, the result of which determines further tactics. The absence of an extensive surgical wound after laparoscopic appendectomy practically excludes her suppuration, divergence of seams, event, bleeding. It is possible to perform an intraoperative adequate assessment of the severity of the course, the prevalence of the inflammatory process. The minimum area of damage (puncture) practically excludes the formation of adhesions in the area of the postoperative wound and provides a good cosmetic effect.

Reducing the intraoperative load on the baby's body contributes to the early recovery of physical activity of the patient and reduces the use of analgesics to a minimum, which leads to a reduction in hospitalization [2].

In the technical aspect, the implementation of endovideosurgical treatment in the widespread forms of appendicular peritonitis differs: some authors use laparoscopy as a method for diagnosing and sanation of the abdominal cavity, then perform a conversion, it occurs in 0.9-20% of cases of peritonitis in children [25]. However, N. Vettoretto (2004) and others favor this tactic, indicating conversion to laparotomy in special cases of severe peritonitis [18]. In a comparative study, L. Planka (2009) concluded that operative treatment of general appendicular peritonitis using laparoscopy does not lead to an increase in early and late postoperative complications compared to classical methods [19,28].

In pediatric surgery, currently there is no single point of view in the treatment of common forms of appendicular peritonitis in children [12,15,27]. One of the reasons is the absence of a single criterion for assessing the severity of peritonitis, as each surgeon has his own opinion and measure of evaluation. We believe that assessing the severity of the flow of peritonitis with scoring and its use in the choice and scope of surgical intervention will reduce the postoperative complication, reduce the number of unreasonable conversions, and, if necessary, give indications for laparotomy and laparostomy. Determination of criteria for assessing the severity of peritonitis is an effective method in the choice of operational tactics for treating peritonitis, which allows to minimize the subjectivism of the surgeon, optimizes the approach to therapeutic tactics in appendicular peritonitis in children.

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