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Modern Approaches To Surgical Treatment Of Congenital Abdominal Malformations In Newborns

Alina Mikhailovna Khruleva[1], Dagmara Khasambekovna Edelkhanova[2], Kalimat Magomedovna Magomedova[3], Mislimat Mayidinovna Sultanova[4], Makka Dzhabrailovna Alikhadjieva[5], Karina Maratovna Akhmadullin[6], Daniil Glebovich Yakunin[7]

[1]Pirogov Russian National Research Medical University (RNRMU),1 Ostrovityanova str., Moscow, 117997, Russia.
Email ID: dreammaker1107@mail.ru, 0009-0007-0329-615X,

[2]Federal State Budgetary Educational Institution of Higher Education "Astrakhan State Medical University" of the Ministry of Health of the Russian Federation, 121 Bakinskaya, Astrakhan, 414000, Russia,
Email ID: edelkhanova.01@mail.ru, 0009-0003-7111-6211

[3]Astrakhan State Medical University, Bakinskaya str., 121, Astrakhan, Astrakhan region, Russia, 414000.
Email ID: kalimatmm05@gmail.com, 0009-0001-6735-6867

[4]Astrakhan State Medical University, 121 Bakinskaya Street, 414000.
Email ID: mislimatsultanova@gmail.com, 0009-0004-8099-2376

[5]Federal State Budgetary Educational Institution of Higher Education "Astrakhan State Medical University" of the Ministry of Health of the Russian Federation, 121 Bakinskaya, Astrakhan, 414000, Russia.
Email ID: makkaalikhadjieva06@mail.ru, 0009-0004-1076-2524

[6]Izhevsk State Medical Academy, 281 Kommunarov Street, Izhevsk, 426056, Russia.
Email ID: kari.axmadullina@yandex.ru, 0009-0002-2560-0953

[7]irogov Russian National Research Medical University, 1 Ostrovityanova St., Moscow, 117997, Russia.
Email ID: dgyakunin@gmail.com, 0009-0002-4089-2974

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ABSTRACT

The presented scientific work reviews modern approaches to surgical treatment of congenital abdominal malformations in newborns, including analysis of the effectiveness of minimally invasive and open techniques, assessment of the incidence of postoperative complications, description of factors affecting long-term prognosis, and issues of optimization of management tactics.

The work is based on the study of 168 clinical cases collected in two specialized perinatal centres. The data on the nature of congenital malformations, baseline health indicators of newborns, performed surgical interventions and results of postoperative follow-up were analyzed.

Based on the obtained data, practical recommendations were formulated to increase survival rate, reduce the risk of complications and improve the quality of life of children with congenital abdominal anomalies.

Keywords: *congenital malformations of abdominal cavity organs, newborns, modern surgical approaches, laparoscopy, surgical treatment, neonatal surgery.*

1. INTRODUCTION

Modern neonatal surgery has a wide arsenal of techniques aimed at the correction of congenital abdominal malformations in newborns. The problem remains relevant due to the fact that these anomalies are often combined with severe concomitant pathologies, increase the risk of neonatal mortality and worsen the further quality of life of the child. According to data from leading perinatal centres, the incidence of such malformations as gastroschisis, omphalocele, intestinal atresia and biliary

system anomalies remains at a consistently high level, despite advances in prenatal diagnosis and improved methods of intrauterine fetal monitoring.

The use of high-resolution ultrasound technology and magnetic resonance imaging (MRI) allows increasingly accurate detection of congenital anomalies in the fetal period [6]. However, the choice of the optimal timing and volume of surgical intervention after birth remains a difficult task, as it depends not only on the anatomical features of the pathology, but also on the general condition of the child, the degree of maturity of vital systems, the presence of concomitant malformations and the capabilities of the institution where treatment is performed. All this makes it necessary to search for unified approaches and to develop protocols that take into account the individual characteristics of each patient [1].

The aim of this study was to determine the most effective strategies for surgical correction of congenital abdominal malformations in newborns and to analyze the factors affecting the incidence of postoperative complications, survival rate and length of hospital stay. Based on this goal, we solved the tasks of collecting and analyzing data on the clinical course of various forms of malformations, comparing the results of traditional open and minimally invasive surgery, and assessing the importance of an interdisciplinary approach and the level of training of specialists.

The results obtained are of interest to paediatric surgeons, neonatologists and other medical specialists working in the field of perinatal medicine. The analyzed material makes it possible to develop more detailed treatment algorithms and optimize both surgical techniques and the postoperative management programme, including respiratory support and nutritional correction. Proper organization of care for these children at all stages - from prenatal diagnosis to discharge from a specialized hospital - ultimately contributes to a reduction in neonatal mortality and an improvement in the quality of life of patients.

2. MATERIALS AND METHODS OF THE STUDY

A sample of 168 newborns with congenital abdominal malformations was formed for more detailed analysis. All babies were admitted to two multidisciplinary perinatal centres at different times between 2019 and 2023. Inclusion in the study was based on the following main criteria:

1. Confirmed diagnosis of congenital abdominal organ anomaly (gastroschisis, omphalocele, various forms of intestinal atresia, biliary system anomalies, congenital diaphragmatic hernia, etc.).

2 Absence of contraindications to surgical treatment, including malformations not comparable with life, not subject to surgical correction.

3. Body weight of the newborn from 1800 g and above (lower weight categories could be included in the study on an individual basis, provided that surgeons considered it possible and expedient to perform the operation).

4. Informed consent of the child's parents or legal representatives for the surgical intervention and participation in the study follow-up.

A Detailed individual card was prepared for each child, including passport data, anamnesis, results of prenatal examinations and laboratory and instrumental tests performed after birth. In addition, all information on the severity of the condition (SNAP-II scale) at the time of admission to the hospital, data on the type and volume of surgical intervention, peculiarities of the postoperative period and outcomes were recorded.

The average gestational age of the patients was 37.4 weeks, about 40% of the children were born prematurely (34 to 36 weeks), and the remaining 60% were born prematurely. Body weight ranged from 1800 to 4000 g. The mean weight for the group was 2800±320 g. It is known that prematurity and low body weight are risk factors for the development of postoperative complications, which was confirmed during further analysis.

The distribution of SNAP-II scores was as follows: 44% of the children had severity scores less than 10 (mild), 38% had scores between 10 and 15 (moderate), and the remaining 18% had scores over 15 (severe). It is in the latter category that the most complex cases of multiple malformations or combination of abdominal malformations with other severe diseases were observed [4].

The need for surgical treatment was determined by a combination of factors: the anatomical structure of the malformation, the risk of rapid progression of the pathology (intestinal obstruction, threat of perforation, organ compression and organ dysfunction) and the general condition of the child, assessed both by the SNAP-II scale and by a number of other clinical features (presence of respiratory failure, cardiovascular disorders, metabolic disorders, etc.)[11].

Thus, the formed sample allowed us to take into account a wide range of clinical variants of congenital abdominal malformations and associated conditions in newborns. This creates conditions for comparison of different treatment methods and in-depth evaluation of their efficacy and safety in a wide variety of clinical situations. The following results and discussion are based on this sample, covering both relatively mild cases (single malformation with satisfactory general condition) and extremely severe forms of combined pathologies in premature infants with a body weight of less than 2000 g.

3. RESULTS AND DISCUSSION

The study sample included 168 children with various forms of congenital abdominal malformations. The mean birth weight was 2800±320 g, and the mean gestational age was 37.4 weeks. Some of the children had a premature gestational age, while others were categorized as premature, and the level of prematurity was more often moderate (34-36 weeks of gestation).

The most frequently detected pathologies were gastroschisis, omphalocele, small intestinal atresia, biliary tract anomalies and congenital diaphragmatic hernia. In some cases, a combination of malformations (combinations of developmental disorders of the intestine and other abdominal organs) was observed. Several tables have been compiled to assess the prevalence of specific malformations and the severity of the condition[8].

The following table summarizes the distribution of major forms of congenital abdominal malformations in 168 neonates, mean body weight and gestational age, and SNAP-II score.

Table 1. Distribution of types of malformations and their main characteristics

Pathology	Number (n=168)	Mean body weight (g)	Mean gestational age (weeks)	Mean SNAP-II score
Gastroschisis	50	2650±300	37,1	12
Omphalocele	42	2900±280	38,0	10
Small intestinal atresia	34	2700±350	36,9	15
Abnormalities of the biliary system	22	2950±310	37,7	13
Others (diaphragmatic hernia, etc.)	20	2850±400	37,5	14

The distribution of SNAP-II scores demonstrates that a significant proportion of children had moderate to severe conditions, especially in the case of multiple malformations and complicated neonatal period [3].

For a more detailed analysis, an additional table was created to show the prevalence of different methods of surgical correction in each group of malformations and their association with the risk of postoperative complications. In this case, both classic open interventions and minimally invasive or combined methods were taken into account.

Table 2. Methods of surgical interventions and complication rates

Pathology	Open surgery (number)	Minor invasive techniques (number)	Combined (number)	Frequency of complications (%)
Gastroschisis	35	10	5	18
Omphalocele	30	9	3	15
Small intestinal atresia	27	4	3	25
Abnormalities of the biliary system	14	5	3	20
Others (diaphragmatic hernia, etc.)	12	6	2	22

It can be seen that the use of classical (open) methods prevails. Minimally invasive and combined approaches were most actively used in gastroschisis and omphalocele, because with adequate patient selection they allow to reduce surgical trauma and restore bowel function faster. Combined interventions included the use of laparoscopic assistance for diagnosis and treatment of the defect edges followed by mini-laparotomy [6].

Analysis of postoperative complications revealed that septic conditions and prolonged intestinal paresis were recorded less frequently among children operated on using minimally invasive or combined methods. However, when the malformation is severe (e.g., extensive defect in gastroschisis or multiple intestinal atresia), surgeons have preferred the traditional open access, which provides a more complete view and the possibility of thorough revision. In these children, open surgery tends

to result in a longer period of intensive care unit rehabilitation and a higher incidence of purulent-septic complications [10].

To demonstrate the dynamics of key postoperative parameters, the study constructed charts showing the average length of stay in the NICU and the time frame of transfer to full enteral nutrition [5]. Two charts are described below (explained in the text; the graphical realization is available in the original study material).

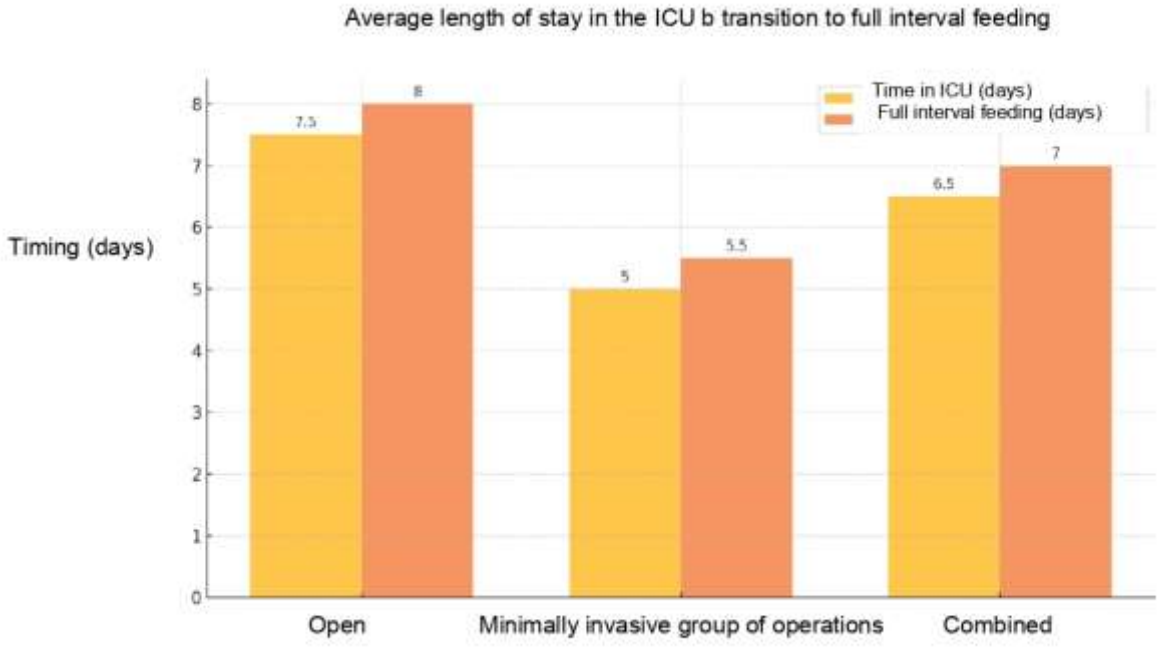

Figure 1 - Average length of stay in ORIT and transition to full enteral nutrition

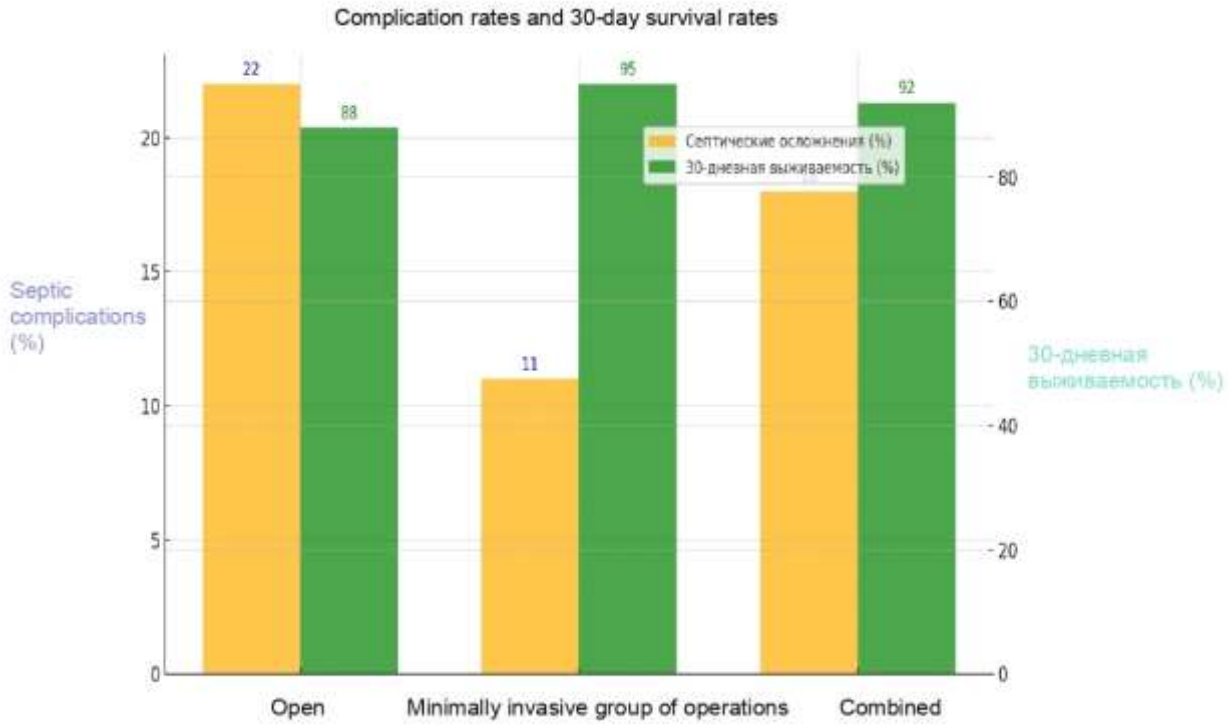

Figure 2 - Frequency of septic complications and 30-day survival rate depending on the method

To assess the influence of malformation complexity and anatomical lesion on treatment outcome, another table was compiled,

where patients were categorized according to the severity of the congenital anomaly.

Complex cases included multiple atresia, combinations of abdominal and thoracic anomalies, severe inflammation, and concomitant genetic abnormalities [3].

Table 3: Dependence of outcome indicators on the complexity of the malformation

Degree of complexity of the malformation	Number of newborns	Minor invasive/combined interventions (%)	Open surgery (%)	30-day survival rate (%)	Intensive care and intensive care unit (d)
Mild/moderate (single abnormality)	98	45	55	95	4,5
Severe (multiple defects)	70	25	75	86	7,2

It is clear from the above data that minimally invasive or combined operations were used much more frequently in patients with simpler anatomy. This was accompanied by a higher 30-day survival rate and shorter ICU stay. In severe forms of malformations, surgeons tended to choose open surgical access, which reflects the real clinical practice in the context of restrictions on the child's body weight, a pronounced inflammatory process or multiple anomalies.

Among the complications recorded during the first 30 days, infectious processes (sepsis, pneumonia, urinary tract infections) prevailed, as well as anastomositis and failure of intestinal anastomosis sutures in case of intestinal atresia. These situations occurred more frequently in children with extremely low or very low birth weight. The high risk of infections in this category of patients was explained both by the peculiarities of their immune status and the need for prolonged vein catheterization and prolonged parenteral nutrition.

Some children who underwent surgery for bile duct atresia required further dynamic monitoring due to the risk of biliary cirrhosis. In a few cases, even early surgical intervention (Kasai operation) did not save from further progression of hepatic insufficiency, and such children were consulted for liver transplantation.

Summarizing the results, it can be noted that the progress of minimally invasive technologies and improvement of anaesthetic techniques have significantly expanded the possibilities of neonatal surgery. However, the decisive factor remains early prenatal diagnosis, which makes it possible to plan delivery in the conditions of a specialized centre and to prepare the child for surgical intervention in a timely manner. The use of combined methods (laparoscopic assisted and small laparotomy) makes it possible to combine the advantages of both approaches, which is particularly important in anatomically complex and at the same time critical cases.

Optimization of postoperative management, including antibiotic and nutritional support regimens, as well as the introduction of new respiratory care technologies, remains among the problems that require further research. It is equally important to improve the system of interdisciplinary interaction, so that specialists of different profiles (obstetricians-gynecologists, perinatal psychologists, neonatologists, surgeons, intensive care specialists and others) work closely together at all stages of care.

4. CONCLUSIONS

A comprehensive study covering 168 newborns with congenital malformations of the abdominal cavity organs confirmed the high clinical significance of modern surgical technologies, including minimally invasive and combined methods, to reduce the traumatic nature of surgery and shorten the rehabilitation period.

It has been established that the choice of surgical access should take into account the severity of the malformation, anatomical features and the child's condition in the postnatal period. The development of diagnostics, especially at the stage of intrauterine observation, opens up opportunities for accurate planning of interventions and reduces risks for the patient.

Timely and adequate postoperative support, including rational antibiotic therapy, multimodal analgesia and early initiation of enteral nutrition, plays a crucial role in reducing the incidence of septic complications and improving long-term outcomes.

Optimization of treatment algorithms, advanced training of specialists and expansion of technical capabilities of perinatal centres are the most important conditions for further reduction of neonatal mortality and improvement of the quality of life of children with congenital abdominal malformations.

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