Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 30s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Methods Of Prevention And Treatment Of Postoperative Complications In Infants Undergoing Surgery In The First Days Of Life

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Cite this paper as: Maria Vladimirovna Badleeva, Aleksandra Igorevna Savina, Vladimir Vasilyevich Rastunin, Sheron Raufovna Rakhamimova, Svetlana Vladislavovna Plekhanova, Alexandra Olegovna Vorobeva, Oyuna Vladimirovna Yundunova, (2025) Methods Of Prevention And Treatment Of Postoperative Complications In Infants Undergoing Surgery In The First Days Of Life. *Journal of Neonatal Surgery*, 14 (30s), 829-834.

ABSTRACT

This article deals with the topical issues of prevention and treatment of postoperative complications in infants who underwent surgical interventions in the first days of life. The specifics of management of newborns with congenital pathologies of various etiologies requiring immediate surgical intervention are revealed, and modern possibilities of intensive care and resuscitation support of such patients are analyzed. The importance of interdisciplinary interaction between paediatric surgeons, neonatologists, anaesthesiologists-resuscitators and specialists in the field of clinical pharmacology is emphasized, which allows timely detection and correction of early manifestations of septic, respiratory, haemodynamic and metabolic disorders.

The work substantiates the need for an integrated approach to diagnosis and therapy, which involves the use of modern monitoring methods, adequate respiratory support, individualized nutritional support, strict control of water-electrolyte balance and a well-thought-out antibacterial policy, taking into account local strains of microorganisms. The etiopathogenesis of the most frequent postoperative complications is highlighted, and data on the effectiveness of extended intensive care protocols are presented.

The study is based on the analysis of clinical cases of 162 children who received surgical care in the first three days of life and demonstrates statistically proven benefits of comprehensive measures aimed at preventing infections and functional disorders.

Risk factors associated with gestational age, body weight, intrauterine development and the presence of comorbid conditions are highlighted. In the context of the global development of neonatal surgery, the paper emphasizes the contribution of

modern technologies and treatment methods in improving the prognosis and quality of life of newborns undergoing early surgical interventions.

Keywords: *neonatal surgery, postoperative complications, prevention, intensive care, resuscitation, neonatology, infants, early surgical interventions, clinical parameters, recovery.*

1. INTRODUCTION

Modern neonatal surgery is faced with a wide range of congenital anomalies and critical conditions that require urgent surgical intervention in the first hours or 24 hours of a child's life. Emergency surgical care is crucial for preserving the life of the infant, but such interventions carry significant risks of postoperative complications due to the increased vulnerability of the newborn organism. Incompleteness of the immune system, functional immaturity of organs and systems, and heterogeneity of the clinical picture create additional difficulties in choosing the optimal tactics of treatment and prevention of complications.

Early postoperative complications in infants can affect almost all vital systems, including respiratory, cardiovascular, digestive and nervous systems. Infectious processes, despite significant advances in antibiotic therapy, continue to be one of the main causes of unfavorable outcome in the neonatal period. At the same time, rapid progressive septic conditions and multidrug-resistant forms of bacterial flora pose a particular danger, which poses a challenge for specialists to continuously improve preventive measures [9]. The prevalence of respiratory and haemodynamic disorders is directly related to the relative immaturity of the lungs and regulatory centres, as well as the limited compensatory capacity of the cardiovascular system at such an early age. The digestive system, in turn, is at risk of necrotizing enterocolitis and other critical conditions arising from insufficient blood supply and fluctuations in intraluminal pressure.

Traditional methods of postoperative management, although they have undergone significant evolution towards gentler and more effective approaches, are not always able to fully mitigate all emerging risks. The task of modern medicine is to find and implement algorithms capable of detecting the initial manifestations of infections, metabolic and functional disorders as early as possible, as well as to prevent their progression in a timely manner. In this context, multidisciplinary coordination is becoming increasingly important, with teams of surgeons, intensive care specialists and neonatologists working together to form an individualized treatment strategy for each patient, taking into account the characteristics of their diagnosis and gestational maturity[5].

The aim of this article is to present the results of a study aimed at evaluating the effectiveness of various methods of prevention and treatment of postoperative complications in infants who underwent surgical interventions in the first days of life, as well as to develop practical recommendations for optimizing the management of this group of patients.

It focuses on factors that influence the likelihood of complications, including fetal maturity, intrauterine development, maternal antenatal pathology, the timing and nature of preoperative preparation, and the anaesthetic and postoperative intensive care techniques used. Particular importance is given to a number of critical indicators: gestational age, body weight, blood pressure, oxygenation, blood gas parameters and inflammatory markers. Individualized monitoring and timely adjustment of therapeutic measures allow not only reducing the risk of critical complications, but also favorably affecting the recovery process.

The paper also discusses relevant aspects of nutritional support, which serves as a cornerstone for full tissue regeneration and preservation of immune function, especially in the context of major surgeries. Optimal combination of enteral and parenteral nutrition, selection of the necessary concentration of micro- and macronutrients, as well as protein and energy supply directly correlate with the success of rehabilitation. At the same time, the importance of prevention of nosocomial infections is emphasized, which is based on strict observance of sterility and rational antibacterial tactics, taking into account local microbial resistance.

The results of this study have a practical orientation and can be used in the work of intensive care units, perinatal centres and specialized children's clinics providing round-the-clock surgical and intensive care for newborns. The obtained data allow not only to evaluate the effectiveness of different therapeutic and preventive approaches, but also to form a more balanced strategy of resource allocation and organization of comprehensive care for patients whose prognosis depends largely on the quality and coherence of therapeutic measures in the first days of life.

2. MATERIALS AND METHODS OF THE STUDY

The study was conducted in the neonatal surgical department of a multidisciplinary medical centre specializing in the provision of high-tech care to newborns with critical congenital pathologies. Observation covered a period of three years, during which data from 162 infants who underwent complex surgical interventions in the first three days after birth were

analyzed. Inclusion criteria were based on the nature of the surgical intervention, which made it possible to differentiate patients by specific types of pathology. The largest number of operations was performed for congenital malformations of the gastrointestinal tract, diaphragmatic hernia, congenital heart defects, and a number of emergency conditions associated with life-threatening developmental anomalies.

The data set collected included clinical parameters of newborns at birth and throughout the postoperative period. Parameters related to the severity of the initial condition, the peculiarities of the course of the pathology, the anaesthesia methods used, the nature of intraoperative support, the presence or absence of neonatal resuscitation care, and the state of the haemodynamic and respiratory systems were analyzed. The study paid special attention to factors that can influence the occurrence of complications, including gestational age, the presence of intrauterine infections and concomitant pathologies in the mother, and the course of pregnancy and labour.

Data were collected through a systematic examination including clinical, laboratory and instrumental methods [4]. Laboratory tests included evaluation of general and biochemical blood counts, inflammatory and infection markers. Blood gas composition, dynamics of lactate level and other metabolic indicators were monitored, which made it possible to assess the degree of compensation or decomposition of critical conditions in newborns. The diagnostic complex also included ultrasound monitoring of internal organs, including the heart and brain, and, if necessary, radiological and computed topographic methods.

Statistical processing methods were used, including both descriptive statistics and correlation analysis [1]. We considered the incidence of various complications, the timing of their appearance, the severity of clinical symptoms, as well as the effectiveness of various methods of prevention and treatment. Regression analysis methods were used to identify the relationship between individual variables, such as body weight, gestational age or method of anaesthesia, and the likelihood of complications.

3. RATIONALE FOR THE FINDINGS

In order to objectify the data in the study, measures were taken to standardize the follow-up protocols. The developed patient follow-up charts contained a unified structure for recording clinical and laboratory parameters, which made it possible to compare data for different groups of patients without methodological discrepancies. Special attention was paid to adherence to ethical principles, which involved obtaining informed parental consent for research and collecting the necessary medical data.

The study compared different approaches to the management of the postoperative period. Some patients received standard therapy, including basic resuscitation and intensive care techniques and conventional antibiotic prophylaxis regimens. Other patients, in case of appropriate indications, received extended treatment protocols that included the use of modern antiseptic methods, immunotropic drugs, innovative methods of respiratory support and nutritional support.

A number of quantitative parameters were used to assess the dynamics of complications, namely the average time of infectious processes, the structure of complications, the incidence of respiratory failure and the need for repeated surgical intervention [3]. These data were systematized in tables and visualized using graphs showing the changes in key parameters depending on the treatment tactics used.

The following table summarizes the most common complications and their frequency. The table takes into account all analyzed cases and shows the baseline dynamics.

Table 1. Frequency and pattern of postoperative complications in infants undergoing surgical interventions in the first three days of life.

Name of complication	Absolute number of cases (n=162)	Percentage of total number
	46	28,4%
Infectious complications (sepsis, peritonitis, pneumonia)	38	23,5%
Respiratory failure requiring prolonged ventilation	31	19,1%
Haemodynamic disorders (arterial hypotension, shock)	23	14,2%
Digestive disorders (necrotising enterocolitis, intestinal ischaemia)	19	11,7%
Thrombotic and haemorrhagic complications	5	3,1%

The data from the table show a predominance of infectious complications in infants undergoing surgical interventions, as well as a significant proportion of cases associated with respiratory failure. Haemodynamic disorders and digestive problems also occupy a significant position among the main complications.

The results reflecting the dynamics of complication rates over time depending on the applied prophylaxis techniques are presented in the form of a graph. The horizontal axis shows time intervals (in days after surgery), and the vertical axis shows the generalized percentage of infants with reported complications. The dots on the graph indicate the percentages for the control and experimental groups, where extended treatment protocols were used in the experimental group.

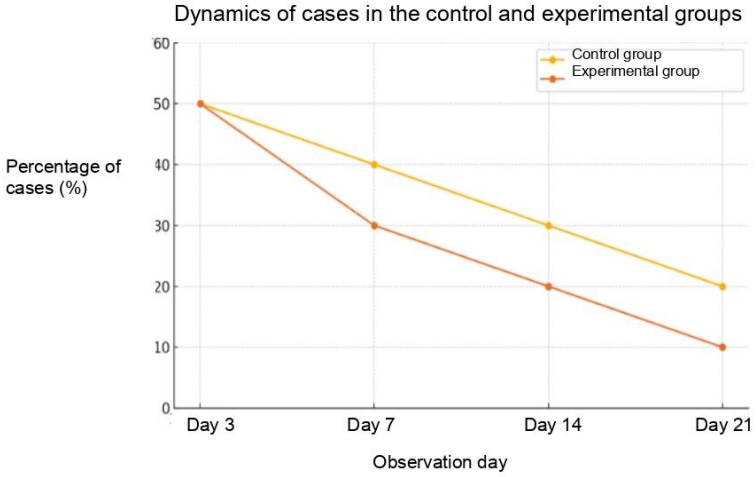

Figure 1 - Dynamics of cases in the control and experimental groups

The graph shows that on the 3rd day after surgery the complication rate in both groups is approximately comparable. However, by the 7th day, the experimental group shows a slight decrease in the rate of complications compared to the control group. By the 14th and 21st day, this gap becomes more pronounced, indicating the effectiveness of the extended prophylaxis methods used.

The collected quantitative data and graphical representation provide an opportunity to compare in more detail the dynamics of complications in different therapeutic regimes. To obtain additional accuracy, statistical analysis was carried out, including the assessment of the reliability of differences by the chi-square criterion for frequency indicators and Student's t-criterion for values expressed as mean values. The level of statistical significance was taken as 0.05.

Processing of the obtained data demonstrated that the main predictors of postoperative complications in the study group were the severity of the child's condition at birth, the nature of congenital pathology, the timing of surgical intervention, and the presence of intrauterine infection factors. The assessment of gestational age and body weight of the child was important, since profoundly premature infants often develop complications associated with immaturity of organs and systems [2].

It was noted that the group of children who received extended prophylaxis protocols achieved a lower incidence of infectious complications, including septic conditions. This result is explained by the use of a multimodal approach, which included timely antibacterial therapy taking into account the peculiarities of the microbial landscape of the department, the use of modern antiseptic procedures for catheter and drainage care, as well as immunity support through parenteral nutrition enriched with the necessary nutrients.

Regular monitoring of respiratory support parameters made it possible to timely adjust the settings of artificial ventilation devices, reduce pressure and oxygen concentration, and use non-invasive methods, which, in turn, reduced the risk of traumatisation and inflammatory reactions in the lungs. More frequent sessions of tracheobronchial sanation using sterile solutions and modern suctioning systems were performed in the experimental group, which contributed to the prevention of pneumonias and complications associated with the accumulation of secretion in the airways.

To prevent haemodynamic disorders such as arterial hypotension and shock, protocol infusion therapy was used, taking into account the individual metabolic needs of each child. This explains the reduced frequency of critical hypotension episodes in children from the experimental group. An integrated approach to blood pressure stabilisation included the use of vasoactive agents, early diagnosis and correction of water-electrolyte balance disorders, and consideration of body weight dynamics reflecting possible changes in water and electrolyte status.

Prevention of thrombotic and haemorrhagic complications was based on precise adherence to anticoagulant and antiaggregant regimens when indicated. It was important to avoid systematic hypocoagulation, which could provoke

haemorrhage, or hypercoagulability, which could lead to thrombotic complications critical for premature and debilitated infants [10].

The statistically significant difference in the complication rate between the control and experimental groups indicates that a comprehensive approach to therapy and prevention can significantly reduce the risk of adverse outcomes. A detailed analysis of clinical cases leading to the development of serious complications demonstrated that in a number of situations associated factors (e.g., severe intrauterine infection, late diagnosis, the need for repeated surgical interventions, complex congenital malformations) had a decisive influence on the outcome.

An important aspect of the study was to identify the role of the multidisciplinary team in achieving favourable outcomes. The presence of specialists in neonatology, paediatric surgery, anaesthesiology, intensive care, resuscitation and clinical pharmacology working in close collaboration in the department allowed timely correction of treatment, risk modeling and optimal decision-making. The nursing and nursing staff involved in the study also contributed to compliance with nursing protocols, sanitation and hygiene standards and prevention of hospital-acquired infections [9].

Further analysis showed the importance of improving the algorithms of nutritional support in the neonatal period. Children from the experimental group, where individualized parenteral nutrition with the addition of amino acids, lipid emulsions and micronutrients was used, showed faster recovery of body weight and increased resistance to infectious influences. These data confirm that adequate nutritional support can strengthen the body's own defense mechanisms, increasing its ability to cope with the stress of surgery.

Patients with severe combined malformations remain a serious challenge for neonatal surgeons and intensive care specialists [4]. In cases requiring repeated interventions or a long postoperative period with several stages of surgical correction, the risk of complications increases manifold. That is why it is extremely important to plan in advance the surgical tactics with the participation of the entire multidisciplinary team, observing the stages and carefully monitoring the dynamics of the infant's condition at each stage of treatment [7].

The effectiveness of the presented methods was confirmed by the results of statistical analysis, where a significant decrease in the incidence of infectious complications ($p<0.05$) and respiratory problems ($p<0.05$) was noted, as well as a trend towards a reduction in necrotizing enterocolitis and haemodynamic disorders. Although some complications still occur with extended treatment protocols, an integrated approach allows in some cases to mitigate their course or detect early symptoms in a timely manner, thus increasing the chances of a favourable outcome.

4. CONCLUSIONS

The study indicates that the prevention and treatment of postoperative complications in infants who underwent surgical interventions in the first days of life requires a comprehensive approach that takes into account the multifaceted features of the newborn organism. Optimization of medical care is achieved through close integration of neonatological, anesthesiological, surgical and resuscitation practices, as well as the widespread use of modern diagnostic, monitoring and therapeutic interventions. Adequate organization of the treatment process in specialized departments with highly qualified staff and the necessary technological equipment becomes the main condition for the successful implementation of these measures.

The results of comparison of standard and extended tactics of postoperative period management demonstrate that timely use of complex measures aimed at preventing infectious, respiratory, haemodynamic and other complications contributes to improved survival rates and reduced incidence of adverse outcomes. Competent use of antibacterial agents taking into account local microflora, correct respiratory support using gentle ventilation methods, control of hemodynamics and metabolic processes, adequate nutritional support and organization of interdisciplinary cooperation can significantly reduce the risk of postoperative complications and achieve a more favourable prognosis for infants.

Despite the positive results, there are still a number of unresolved issues that require further study. These include the improvement of early diagnosis and monitoring methods, the development of new ways to stimulate regenerative processes in newborns, and the strengthening of pathogenetically based pharmacotherapy. A significant role can be played by future research aimed at in-depth study of the molecular and immunological basis for the development of complications in the postoperative period in infants[11].

Thus, the introduction of complex techniques for the prevention and treatment of postoperative complications in children who underwent surgery in the first days of life provides a reduction in the risk of severe consequences, shortening the duration of hospitalization and improving the quality of life of patients. The results obtained allow us to recommend the use of extended protocols for the management of newborns, taking into account the individual characteristics and multidisciplinary nature of their pathology, which opens up prospects for further development of neonatal surgery and improvement of prognostic indicators in this field of medicine.

"This study was conducted with the support of Dorzhi Banzarov Buryat State University, Order No. 49-OD dated 12.02.2025"

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