

Peculiarities Of Postoperative Rehabilitation In Children After Surgical Treatment Of Congenital Heart Disease

Ekaterina Dmiriyevna Shpak¹, Aishat Imamguseynovna Hasanova², Maryam Lom-Alievna Usmanova³, Zubair Yunadievich Said-Eminov⁴, Zaynam Murtuzalievna Ibragimova⁵, Djamilya Arsanalievna Osmanova⁶, Mariyat Magomedovna Magomedova⁷

¹Saratov State Medical University named after V.I. Razumovsky (Razumovsky University), Saratov, Bolshaya Kazachya St., 112, 410012, Russia.

Email ID: ekaterina.sh.05@mail.ru, 0009-0006-6949-8443

²Saratov State Medical University named after V.I. Razumovsky, (Razumovsky University), 112 Bolshaya Kazachia St, 410012, Russia.

Email ID: aishat.00903@icloud.com, 0009-0000-3016-2623

³Federal State Budgetary Educational Institution of Further Professional Education "Russian Medical Academy of Continuous Professional Education" of the Ministry of Healthcare of the Russian Federation, 2/1, Barrikadnaya st., Moscow, 125993, Russia.

Email ID: ismail.shaipov.96@mail.ru, 0009-0008-4904-7279

⁴Federal State Budgetary Educational Institution of Higher Education, "Kabardino-Balkarian State University named after H. M. Berbekov", Institute of Dentistry and Maxillofacial Surgery, 175B Tolstogo Street, Nalchik, Russia.

Email ID: zubair180803@gmail.com, 0009-0003-5010-2822

⁵Dagestan State Medical University, Soviet District, Lenin Square, building 1, Makhachkala, 367000, Russia.

Email ID: zaynamibragimova@gmail.com, 0009-0000-1603-0077

⁶Dagestan State Medical University, Soviet District, Lenin Square, building 1, Makhachkala, 367000, Russia.

Email ID: djama_osmanova@icloud.com, 0009-0006-6153-1253

⁷Dagestan State Medical University, Soviet District, Lenin Square, building 1, Makhachkala, 367000, Russia.

Email ID: mari_mag200211@mail.ru, 0009-0000-7290-7849

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ABSTRACT

The paper considers theoretical and practical aspects of postoperative rehabilitation of children with congenital heart disease. The study reflects the peculiarities of the dynamics of medical indicators and psychological factors affecting the effectiveness of recovery in the long term.

The analysis of statistical data for the period 2019-2024, a sociological study with the participation of parents of operated children is carried out, the assessment of economic costs of rehabilitation measures is presented.

Practical recommendations for optimizing the system of care and improving the quality of life of patients are proposed.

The results of the study indicate the high significance of an integrated approach including medical, socio-psychological and pedagogical components.

Keywords: rehabilitation, congenital heart disease, surgical treatment, children, medical statistics, quality of life, physiotherapy, psychological support, telemedicine, economic aspects.

1. INTRODUCTION

The problem of congenital heart defects in children remains in the centre of attention of scientists and doctors against the background of increasing birth rate and improvement of medical technologies. Modern methods of cardiac surgery allow saving the lives of most children with congenital heart disease, but postoperative lethality and the need for long-term rehabilitation remain one of the most pressing issues in paediatric practice.

An important circumstance prompting an in-depth study of this topic is the desire of specialists not only to ensure survival, but also to form a solid foundation for the child's full growth and development. In the course of literature review, special attention is paid to the insufficient elaboration of organizational and methodological issues of postoperative rehabilitation, as well as the lack of comparative data on the effectiveness of different models of rehabilitation care [14].

Interest in the topic is increasing under the influence of economic, social and organizational factors. Rising costs of medical services combined with increasing demands on the quality of health indicators of the younger generation create prerequisites for the development of new approaches to the rehabilitation of children with congenital heart disease. No less important is the introduction of social and psychological support mechanisms, as such patients and their families need long-term follow-up to prevent repeated hospitalizations, reduce anxiety and improve their ability to adapt to society. The improvement of the regulatory framework and the adoption of appropriate standards and procedures for the care of children with various forms of congenital heart disease have a significant impact on the systematic organization of rehabilitation [5].

Many studies conducted in major cardiac centers confirm the critical importance of a continuous multilevel approach to child recovery after cardiac surgery. In this work, we analyzed current practices and conducted our own empirical research, which included a study of registries of surgical interventions in several regions of Russia, a survey of families whose children underwent open cardiac surgery, and statistical processing of the dynamics of indicators over the past years. The results obtained are of interest to cardiologists, rehabilitologists and interdisciplinary specialists who face the problem of complex management of paediatric patients in practice.

2. MATERIALS AND METHODS OF THE STUDY

The study was conducted on the basis of three multidisciplinary institutions located in the central, southern and eastern parts of the Russian Federation, which made it possible to collect data on a representative sample and to smooth out regional peculiarities of the health care organization. Patients aged from one month to 14 years who underwent surgery for congenital heart disease were included in the analysis.

The main body of statistical data was generated on the basis of discharge summaries, standard clinical reports, and information from regional registries; parameters related to the duration of hospitalization, complication rate, recurrence rate, and disability group were analyzed. In parallel, a questionnaire survey of parents of operated children was conducted to identify the social, psychological, and economic components of postoperative rehabilitation [6].

There were 146 people who gave informed consent to participate in the study. The questionnaire contained blocks concerning the assessment of accessibility and quality of rehabilitation services received, the financial burden on the family, the degree of satisfaction with medical and psychological counseling, and the feeling of readiness for independent child care after discharge.

Statistical analysis was performed using the SPSS software package: mean values of the studied parameters were calculated, hypotheses about differences between groups were tested, and correlations between the nature of rehabilitation care and final health indicators were studied.

In addition to analyzing primary data, we studied literature reviews for 2018-2025, including Russian and international sources.

Ethical aspects of the study were ensured by adhering to the principles of confidentiality and anonymity, as well as voluntary participation. All data provided by parents were coded and used only in summarized form.

The study methodology, including questionnaires, medical record review and economic analyses, was agreed with the local ethical committees of the three medical institutions involved in data collection.

3. RESULTS AND DISCUSSION

The analysis of medical and statistical indicators allowed us to establish that the number of operations for congenital heart defects in children in the studied regions increased by an average of 17.5% over the period from 2019 to 2024, which is consistent with the nationwide trend towards an increase in the number of cardiac surgical interventions.

Simultaneously with the increase in the number of operations, there was a decrease in postoperative mortality from 3.9% to 2.7%, which may be associated with an increase in the level of technological equipment, improvement of anaesthesia techniques and introduction of unified clinical protocols [9].

The study of discharge epicrises showed that the average length of stay in the intensive care unit decreased over the last five years from nine to six days, and the total length of stay in the hospital decreased by 3-4 days.

An important focus of the study was to analyze the effectiveness of different models of rehabilitation care. Three groups of patients were identified depending on the intensity and complexity of rehabilitation measures [14].

The first group received standard medical and diagnostic support in an outpatient setting without regular participation of a rehabilitologist and psychologist, the second group participated in a day hospital programme including physiotherapy courses and psychologist consultations, and the third group was under the constant supervision of a multidisciplinary team including a paediatric cardiologist, rehabilitologist, psychologist and physical therapy instructor.

Table 1 summarizes the data on the duration of rehabilitation, the frequency of re-hospitalizations and the dynamics of the children's functional status three and six months after surgery.

The indicators were calculated on the basis of analyses of 384 charts, with 134 patients belonging to the first group, 157 to the second, and 93 to the third.

Table 1. Comparison of the effectiveness of rehabilitation programmes in children undergoing cardiac surgery

Characterisation	First group	Second group	Third group
Medium	4,2	6,1	8,5
Repeat	13,2%	8,9%	3,2%
Improvement	62%	77%	89%

Analysis of the data from the table shows a higher level of effectiveness with multilevel support, which is reflected in a lower number of repeated hospitalizations and a more complete recovery of the functional state of the cardiovascular system, confirmed by objective echocardiography indicators. The duration of the rehabilitation period itself, including outpatient visits, telemedicine consultations and regular physiotherapy courses, is longer in the third group. However, this longer period is compensated for by the positive effect on general well-being and reduced costs associated with potential complications [2].

A sociological survey, in which 146 parents participated, assessed their satisfaction with the assistance provided, the level of psychological comfort, and the availability of support from specialists. The majority of respondents (58.9%) indicated that the first three months after surgery are the most difficult, when parents are faced with a lack of information and fears about the child's prospects.

At this stage, a significant number of families (about 43%) noted the lack of available counseling and the difficulty of organizing rehabilitation activities, especially in regions with an insufficient number of profile centers. At the same time, 26% of the study participants reported a positive experience of cooperation with volunteer associations and charitable foundations, which provided both material and advisory support [12].

Table 2 shows data on the average amount of parents' financial expenses related to postoperative rehabilitation of their children. The calculation included expenses for the purchase of medications, transport costs for regular visits to specialists, and additional psychological and pedagogical support.

Table 2. Average financial expenditures of parents (RUB/month) for postoperative rehabilitation of children during the first six months

Expenditure item	Expenses (rub./month)
Expenditure on rehabilitation services and medicines	8500–12000
Expenditure on psychological and pedagogical support	4000–600
Transport	2000–5000
Other	3500–7000

The total costs can reach 20,000-30,000 rubles per month per family, which is a significant financial burden for low-income regions. This prompts parents to either reduce the number of activities related to rehabilitation or seek alternative sources of

funding, which is not always possible to do quickly [7]. Comparison of group data has shown that with full multidisciplinary support, parents' real costs decrease already from the second half of the year due to a more stable health status of the child and the absence of the need for frequent planned hospitalisations [3].

The potential of telemedicine technologies in rehabilitation was considered as one of the promising areas of research. It was determined that remote monitoring of the progress of recovery, organisation of online consultations and psychological sessions gives parents a sense of greater security and helps to promptly adjust the treatment regimen in case of signs of complications. This reduces anxiety levels and promotes more active family participation in the rehabilitation process [14].

Figure 1 schematically shows the dynamics of changes in the indicators of parents' self-assessment of the level of awareness and psychological comfort, calculated by semi-annual slices.

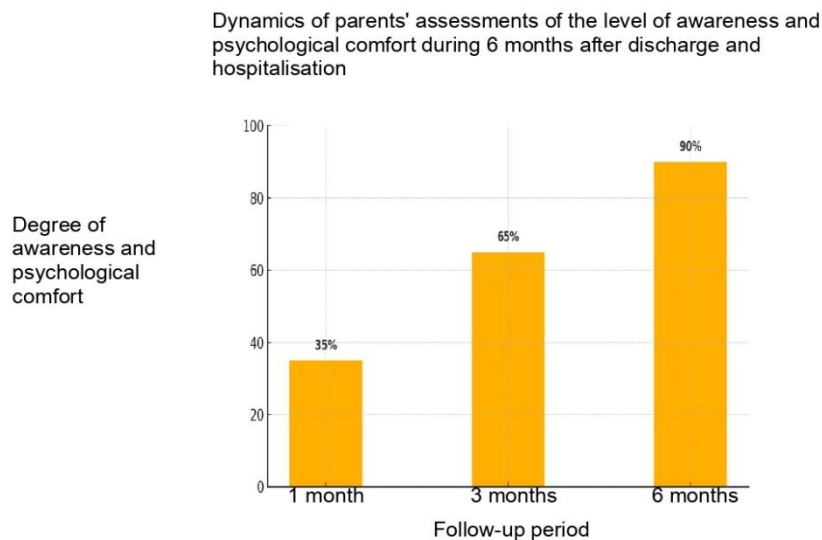


Figure 1: Dynamics of parents' assessments of the level of awareness and psychological comfort during 6 months after discharge from the hospital.

The figure shows the percentage of parents who indicated a high or medium level of satisfaction with rehabilitation support and information availability. It can be seen that with each month of the postoperative period the indicator increases, which reflects the strengthening of interaction between families and specialists, as well as the gradual reduction of stress. Regular counseling, including online counseling, is a significant contributor to the improvement.

Of additional interest is the assessment of functional indicators of children in the post rehabilitation period [15].

Figures 2-3 show a comparative analysis of changes in heart rate and physical endurance indices, as well as the results of the test measured with a six-minute walk. The study was conducted in three stages: one month after surgery, three months and six months later.

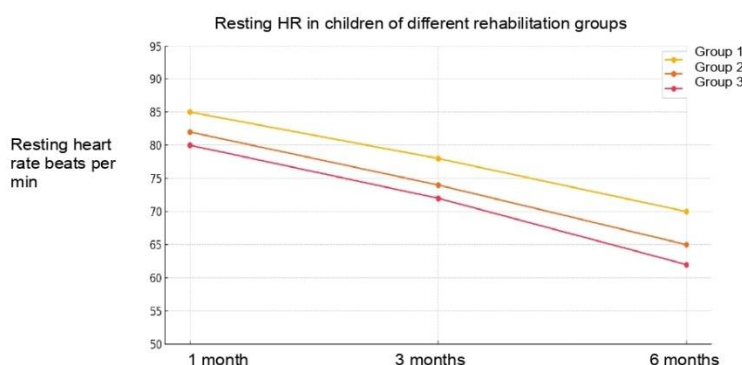


Figure 2 - Resting HR in children of different rehabilitation groups



Figure 3 - Results of the post-walking test

Based on the presented graphs, we can note the gradual improvement of cardiovascular system and physical endurance indicators in children depending on the rehabilitation programme. The most pronounced positive dynamics is observed in the third group, where already by the third month the heart rate decreases more significantly compared to other groups, reaching the best values by the sixth month (about 62 beats/min). At the same time, the distance in the six-minute walk test in the third group increases to the maximum values (about 460 m), which indicates the high efficiency of the rehabilitation measures applied in this group. The first and second groups also show positive dynamics, but the changes in them are less pronounced, especially the first group lags behind. Thus, the graphs confirm the advantage of the intensive rehabilitation programme used in the third group in terms of normalizing physiological parameters and increasing the physical activity of children after cardiac surgery.

Discussing the results obtained, we can conclude that rehabilitation of children who have undergone heart surgery cannot be limited to medication recommendations and infrequent visits to the local cardiologist. A multidisciplinary approach involves a number of specialists and close co-operation with the child's family. Since a significant proportion of parents experience emotional difficulties and financial problems, the social and psychological component of comprehensive rehabilitation is of particular importance. The importance of early inclusion of psychological support and adaptation measures, which should preferably begin while the child is still in hospital, is confirmed.

Parents who participated in the study often noted insufficient attention to the factors of psychological adaptation. This situation is caused by the workload of doctors, lack of child rehabilitation specialists and fragmentation in the system of care organization. The problem is exacerbated by families' lack of awareness of free counseling opportunities and the lack of telemedicine platforms that would allow remote contact with leading specialists [8]. As the use of online technologies can increase both awareness and accessibility of medical care, further development of telemedicine services seems to be one of the important organizational directions [11].

In comparison with the works presented in domestic and foreign literature, the results of this study confirm the high efficiency of early activation, although they emphasise the importance of an individual approach, taking into account the type of malformation, age and general condition of the child. Consideration of socioeconomic factors shows that the overall cost burden may lead families to forego comprehensive rehabilitation and increase the risk of recurrent complications. A rational model should include economic support mechanisms and well-defined pathways that allow seamless interaction between inpatient, outpatient and outpatient services and referral centers.

4. CONCLUSIONS

The conducted study allows us to form a holistic view of the multifaceted nature of the process of postoperative rehabilitation of children with congenital heart disease.

The analysis of statistical data and the results of surveys indicate that high-tech operations lead to a decrease in postoperative mortality and disability, but the quality and duration of life largely depend on the availability and intensity of rehabilitation measures.

Multidisciplinary programmes involving cardiologists, rehabilitologists, psychologists and educators provide a more pronounced positive effect, reduce the risk of repeated hospitalizations and the overall financial burden on the family in the long term.

The most promising areas for development are strengthening the organizational structure of paediatric cardiac rehabilitation, attracting volunteer and charitable resources, expanding the possibilities of telemedical monitoring and parental support systems.

In the context of current economic and technological challenges, the most important factors in improving this sphere are the improvement of specialists' qualifications, the creation of unified clinical recommendations, and the development of networking between medical and social institutions.

The findings can be used in further development of rehabilitation programmes aimed at increasing the duration and improving the quality of life of children who have undergone surgical correction of congenital heart disease.

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