Comprehensive rehabilitation of patients after combined cardio and oncosurgical interventions

Rehabilitación integral de pacientes tras intervenciones combinadas cardiológicas y oncoquirúrgicas

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Abstract

The article discusses modern approaches to the comprehensive rehabilitation of patients who have undergone combined cardio- and oncosurgery interventions. This category of patients is a special risk group, as it requires simultaneous consideration of the complexity of cardiac and oncological pathologies, and the specifics of postoperative recovery after high-tech surgical interventions. The article emphasize that the success of the rehabilitation process directly depends on the timely initiation of rehabilitation measures, their adaptation to the individual characteristics of the patient and the use of a multidisciplinary approach. The methods of drug correction aimed at stabilizing the state of the cardiovascular system and preventing the recurrence of the oncological process are taken into account. Various aspects of non-drug treatment are considered, including physical rehabilitation, breathing exercises, psychological and emotional support, and lifestyle correction. Given the results, coordination of the actions of various specialists makes it possible to provide an integrated approach to restoring the patient's functional capabilities, improving his quality of life and reducing the incidence of complications. In addition, the need to introduce new methods for monitoring patients' condition, such as telemedicine technologies and wearable devices for monitoring health indicators, is being considered.

Keywords: comprehensive rehabilitation, cardiac surgery, oncosurgery, rehabilitation treatment, multidisciplinary approach.

Resumen

El artículo analiza los enfoques modernos para la rehabilitación integral de pacientes que se han sometido a intervenciones combinadas de cirugía cardiaca y oncoquirúrgica. Esta categoría de pacientes constituye un grupo de riesgo especial, ya que requiere una consideración simultánea de la complejidad de las patologías cardíacas y oncológicas, así como de las particularidades de la recuperación postoperatoria tras intervenciones quirúrgicas de alta tecnología. El artículo enfatiza que el éxito del proceso de rehabilitación depende directamente del inicio oportuno de las medidas rehabilitadoras, su adaptación a las características individuales del paciente y el uso de un enfoque multidisciplinario. Se tienen en cuenta los métodos de corrección farmacológica dirigidos a estabilizar el estado del sistema cardiovascular y prevenir la recurrencia del proceso oncológico. Se abordan diversos aspectos del tratamiento no farmacológico, incluyendo la rehabilitación física, ejercicios respiratorios, apoyo psicológico y emocional, y la corrección del estilo de vida. A la luz de los resultados, la coordinación de las acciones de diversos especialistas permite ofrecer un enfoque integral para la recuperación de las capacidades funcionales del paciente, mejorar su calidad de vida y reducir la incidencia de complicaciones. Además, se considera la necesidad de incorporar nuevos métodos de seguimiento del estado del paciente, como las tecnologías de telemedicina y los dispositivos portátiles para el monitoreo de indicadores de salud.

Palabras clave: rehabilitación integral, cirugía cardíaca, oncoquirugía, tratamiento rehabilitador, enfoque multidisciplinario.

Introduction

Modern medicine has achieved significant success in the field of cardio and oncosurgery, which has significantly increased the number of patients who have undergone high-tech combined operations. However, the combination of cardiovascular and oncological diseases presents a unique challenge for rehabilitation medicine. Patients who have undergone such interventions face a variety of physiological, psychological and social problems that require an integrated approach to recovery[1-3].

Cardioncological surgical interventions are often performed in older patients who have various concomitant diseases, which complicates the rehabilitation process. For example, prosthetics of heart valves can be performed simultaneously with resection of a lung tumor or other organ, which creates an additional burden on the patient's body [2]. After such operations, the risk of complications such as infections, thromboembolic events, cardiac dysfunction, or cancer recurrence increases significantly, which is why effective rehabilitation becomes an integral part of the postoperative period.

In recent years, more and more attention has been paid to the development of individualized rehabilitation programs that take into account the characteristics of each patient, which includes not only restoring physical functionality, but also working on a psychoemotional state, which is especially important for patients with cancer. Stress, anxiety, and depression can significantly hinder the recovery process, reducing the patient's motivation to actively participate in rehabilitation activities[4-6].

Against the background of these challenges, the relevance of comprehensive rehabilitation of patients after combined cardio- and oncosurgical interventions continues to grow. A multidisciplinary approach combining the efforts of cardiologists, oncologists, rehabilitologists, psychologists and other specialists is becoming a key factor in successful recovery. It is important to note that the development of modern technologies, such as telemedicine monitoring systems and digital platforms for patient support, opens up new opportunities for optimizing rehabilitation programs.

Thus, the purpose of this study is to study modern methods and strategies for comprehensive rehabilitation of patients after combined cardio– and oncosurgical interventions, as well as to identify the most effective approaches to improve the quality of life of this category of patients.

Materials and methods

The study of the issues of complex rehabilitation of patients after combined cardio- and oncosurgical interventions was carried out on the basis of an analysis of thematic sources published over the past 20 years. In addition, a number of methods were used to reveal the essence of the problem under consideration. The scientific literature, clinical guidelines, and international protocols for rehabilitation after cardio- and oncosurgical operations were studied by the method of analysis and synthesis. The analysis allowed us to identify the key components of successful recovery, and the synthesis allowed us to combine them into a single system that takes into account the features of combined pathology.

A comparison of different approaches to rehabilitation used in different countries and medical institutions made it possible to identify the most effective practices and adapt them to the specifics of this category of patients.

To organize information about the types of rehabilitation measures and their impact on the patient's condition, the method of theoretical description and classification is used, which made it possible to structure data on various aspects of recovery, such as physical activity, drug therapy, psychological and emotional support and dietary nutrition. The system analysis made it possible to consider the rehabilitation process as a whole, where all the components are interconnected and interact with each other. Interpretation of data from scientific publications, clinical observations, and expert opinions has allowed for a deeper understanding of the body's recovery mechanisms after combined cardio and oncosurgical interventions.

Results

Patients who have undergone combined cardio- and oncosurgical interventions represent a special risk group, as it requires simultaneous consideration of the complexity of cardiological and oncological pathologies, as well as the specifics of postoperative recovery after high-tech surgical interventions[3]. The main risk factors and their impact on the rehabilitation of patients after combined cardio- and oncosurgical interventions are presented in Table 1.

Table 1. Main risk factors and their impact on rehabilitation of patients after combined cardio- and oncosurgical interventions

Risk Factor / Feature	Description	Impact on rehabilitation
The complexity of comorbid conditions	The presence of concomitant diseases (diabetes mellitus, chronic renal failure, obesity).	It complicates the recovery process and increases the risk of complications.
High physiological load	Combined operations cause significant injury to the body, reducing the functional reserves of the cardiovascular and respiratory systems.	Increases the likelihood of thromboembolic events, infections, heart dysfunction, or cancer recurrence.
Age of patients	Most patients belong to the older age group, which is associated with slow regeneration processes and age-related changes in organs.	Slows down recovery, increases sensitivity to stressful situations.
Psycho-emotional aspects	Oncological diseases often cause anxiety, depression, and fear of the future, reducing motivation for rehabilitation.	It can lead to low activity of the patient, deterioration of the quality of life.
The specifics of drug therapy	The combined use of drugs may be associated with drug interactions (for example, anticoagulants + chemotherapy).	Increases the risk of side effects such as bleeding or toxicity.
Features of physical rehabilitation	The need to adapt physical activity to the limitations caused by the oncological process (for example, after thoracotomy or lung resection).	It requires special techniques to restore breathing and gradually increase exercise.
Long-term observation	Constant monitoring of heart function, blood parameters, the presence of metastases and other parameters is required.	Increases the need for frequent medical check-ups and adjustments to the rehabilitation plan.

In complex comorbid conditions, patients often have serious concomitant diseases such as diabetes mellitus, chronic renal failure, obesity, or dysfunction of other organs, which significantly complicates the rehabilitation process, since it is necessary to take into account not only the underlying pathologies (cardiological and oncological), but also the interaction of all body systems[4]. Combined operations represent a significant injury to the body, which can lead to a temporary decrease in the functional reserves of the cardiovascular system, respiratory system, and other vital organs[5]. This increases the risk of postoperative complications such as infections, thromboembolic events, cardiac dysfunction, or cancer recurrence.

In most cases, patients requiring combined cardio- and oncosurgical interventions belong to the older age group. Elderly people have slower tissue regeneration processes, reduced adaptation to stressful situations, and more pronounced age-related changes in the functioning of internal organs, which makes them especially vulnerable in the postoperative period. Oncological diseases are often accompanied by severe psychological stress, including anxiety, depression, and a sense of fear of the future[6]. These factors can negatively affect the patient's motivation to participate in rehabilitation activities, as well as the overall quality of life. The simultaneous need to recover from cardiac surgery exacerbates these problems. The combined use of drugs for the treatment of cardiac and oncological diseases may be associated with the risks of drug interactions[7].

Physical activity is an essential component of rehabilitation after cardiac surgery, but it must be adapted to the limitations caused by the oncological process. For example, patients with lung resection or thoracotomy may have difficulty breathing, which requires special breathing exercises and a gradual increase in exercise[8]. After combined interventions, constant monitoring of the patient's condition is required, including monitoring of heart function, blood parameters, the presence of metastases and other parameters. This makes it possible to identify potential complications in a timely manner and adjust rehabilitation programs. Rehabilitation of patients who have undergone combined cardio and oncosurgery is a complex multi-stage process covering the early postoperative period, restoration of functional capabilities and long-term maintenance therapy programs[9]. The key stages of rehabilitation of patients after combined cardio- and oncosurgical interventions are presented in Table 2.

Let's look at these steps in more detail. In the early period, the main goal is to minimize the risk of complications and begin to restore the patient's physical activity. Medical correction includes the use of anticoagulants for the prevention of thromboembolic complications, beta-blockers and ACE inhibitors to maintain the function of the cardiovascular system, as well as painkillers to control postoperative pain[10]. If necessary, antitumor therapy can be initiated, adapted to the paatient's condition. Among non-medicinal methods, special attention is paid to respiratory gymnastics to prevent congestion in the lungs, early mobilization (passive limb movements, turning over in bed, gradual walking) and constant monitoring of vital signs such as blood pressure, heart rate and blood oxygen saturation.

During the recovery phase of functional capabilities, the main focus is on restoring motor activity and normalizing the functioning of internal organs[11]. Drug therapy is aimed at correcting antihypertensive and antiarrhythmic drugs to stabilize the cardiovascular system, as well as continuing or initiating anti-cancer therapy, including hormonal or targeted drugs. In case of edema, diuretics can be used[12]. Non-drug methods include a gradual increase in physical activity through endurance exercises and strength training[13]. Patients also engage in special breathing practices using inspiratory simulators to strengthen their breathing muscles. In addition, psychological support plays an important role in helping to cope with stress and anxiety that may occur during this period.

The transition to long-term adaptation aims to prepare the patient for a return to daily life and work. Drug correction includes the stabilization of the medication regimen to maintain the health of the cardiovascular system, as well as the continuation of antitumor therapy under the supervision of an oncologist[14]. An important aspect is the correction of metabolic disorders such as diabetes mellitus or dyslipidemia. Non-drug methods include cardio rehabilitation equipment training, such as walking on a treadmill or riding an exercise bike[15]. An individual nutrition and physical activity plan is also being developed to further maintain the achieved results. Socio-psychological adaptation helps the patient to return to normal life, including issues of employment and interaction with family.

At the stage of maintenance therapy, the main goal is to prevent relapses of diseases and preserve the achieved recovery results. Medical correction includes regular monitoring of the state of the cardiovascular system using ECG, echocardiography and other diagnostic methods, as well as monitoring the level of cancer markers for timely detection of possible relapses[16]. Patients may be prescribed supportive medications such as antiplatelet agents, statins, and blood pressure medications. Among non-medicinal methods, a special place is occupied by supportive physical activity, which should become part of the patient's daily life[17]. Educational programs inform patients about the importance of following dietary recommendations, physical activity, and regular medical supervision. Thus, each stage of rehabilitation has its own unique tasks and methods aimed at comprehensive recovery of the patient after combined cardio- and oncosurgical interventions.

Table 2. Key stages of rehabilitation of patients after combined cardio- and oncosurgical interventions

The rehabilitation stage	Goal	Methods of drug correction
Early postoperative period (1-2 weeks)	Minimization of complications and the beginning of recovery of physical activity.	-Anticoagulants for the prevention of thromboembolism. - beta-blockers and ACE inhibitors for heart maintenance. - Painkillers. - Antitumor therapy (if necessary).
Functional recovery phase (1-3 months 1-3)	Restoration of motor activity and normalization of internal organs.	- Correction of antihypertensive and antiarrhythmic drugs. - Hormonal or targeted therapy in oncology. - Diuretics for edema.
Transition to long-term adaptation (4-6 months)	Preparing the patient to return to daily life and work.	- Stabilization of the medication regimen for cardiovascular health. - Continuation of antitumor therapy. - Correction of metabolic disorders.
Long-term maintenance therapy programs (7+months)	Prevention of relapses and preservation of achieved results.	- Regular monitoring of the state of the cardiovascular system. - Monitoring of cancer markers. - Prescribing supportive medications (antiplatelet agents, statins).

Discussion

The creation of personalized rehabilitation programs is a key factor in the successful recovery of patients after combined cardio and oncosurgical interventions. Each patient is a unique case that requires an individual approach, taking into account a variety of factors such as age, severity of the underlying disease, the presence of concomitant pathologies and the general condition of the body[18]. Ignoring these aspects can lead to a decrease in the effectiveness of rehabilitation, an increased risk of complications and a deterioration in the quality of life.

Age plays an important role in the recovery process. Elderly patients tend to have slower regeneration processes, reduced functional reserves, and a greater likelihood of having chronic diseases. It is important for them to develop more gentle rehabilitation programs with a gradual increase in workload. For example, a young patient can adapt faster to intense physical training, while an older person will need more time to achieve the same results. In addition, psychological stability often changes with age, which requires additional support from specialists[19].

The severity of a cardiological or oncological pathology directly affects the choice of rehabilitation methods. For example, a patient with severe heart failure will not be able to perform the same physical activities as a patient with less severe heart damage. Similarly, in the presence of metastatic cancer, rehabilitation measures should be adapted to take into account possible limitations caused by the spread of the tumor. Personalization allows you to create a program that is safe and effective for this particular patient.

Many patients who have undergone combined cardio and oncosurgery have one or more concomitant pathologies, such as diabetes mellitus, chronic renal failure, obesity, or dyslipidemia[20]. These conditions can significantly complicate the recovery process. For example, diabetes requires special attention to nutrition and blood glucose control, which must be taken into account when developing dietary recommendations. In patients with chronic renal failure, it is necessary to adjust the dosage of medications in order to avoid their accumulation in the body [21].

The general condition of the patient, including his mental and emotional health, physical fitness and stress levels, should also be taken into account when creating a rehabilitation program. Patients with high levels of anxiety or depression may need additional psychological support, while more motivated patients may make faster progress in physical exercise. The general state of the immune system also plays an important role, especially in cancer, where the risk of infectious complications is increased. So, if the patient has a history of severe heart failure and lung cancer, then the program should include minimal physical activity, such as passive limb movements and breathing exercises, with a gradual increase in activity. Drug therapy should be carefully adjusted to minimize drug interactions.

A multidisciplinary team of specialists plays a key role in the successful rehabilitation of patients after combined cardio- and oncosurgical interventions. An integrated approach that ensures coordination of the actions of various professionals allows you to take into account all aspects of the patient's condition, from physiological to psychological characteristics, which significantly increases the effectiveness of recovery[22,23].

Cardiologists are responsible for the stabilization of the patient's cardiovascular system[24]. They monitor blood pressure, heart function, the presence of rhythm disturbances and other factors that may affect the recovery

process. Cardiologists develop individual drug therapy plans, adjust drug dosages, and regularly evaluate the results of ECG, echocardiography, and other diagnostic tests. Their involvement is critically important to prevent complications related to heart failure or thromboembolic events.

Oncologists monitor the course of treatment of the underlying cancer, prescribe the necessary types of therapy (chemotherapy, radiation therapy, targeted therapy) and monitor the level of cancer markers for early detection of possible relapses[25]. They also advise on the prevention and minimization of side effects of anticancer drugs. Cooperation with cardiologists helps to avoid the negative impact of cancer therapy on the cardiovascular system.

Rehabilitologists develop and coordinate common recovery programs, combining the efforts of all members of a multidisciplinary team[26]. They define specific rehabilitation goals, adapt them to the patient's condition, and monitor progress. Rehabilitologists provide communication between different specialists, ensuring an integrated approach to restoring the patient's functional capabilities.

All specialists work together to take into account the interrelationship of various aspects of the patient's health. If the patient's condition changes (for example, if complications occur or organ functions deteriorate), the rehabilitation program can be quickly adjusted. An integrated approach allows not only to restore physical functions, but also to improve the overall well-being of the patient[27-29]. Taking into account all risk factors and timely prevention helps to minimize the likelihood of undesirable consequences.

Thus, the work of a multidisciplinary team of specialists is a harmonious combination of knowledge and experience of different areas of medicine, aimed at achieving maximum effect in the rehabilitation process.

Individual clinical cases demonstrate the effectiveness of modern technologies and recovery techniques used for the rehabilitation of patients with complex pathologies. For example, a 68-year-old woman underwent simultaneous upper lobe resection of her right lung and coronary artery bypass grafting (CABG) due to severe coronary artery disease. After the operation, the patient experienced significant weakness, difficulty breathing, and anxiety. The following rehabilitation methods were used:

– early mobilization: the beginning of active movements 24 hours after surgery (turning over in bed, getting up);

– breathing exercises: using an inspiratory simulator to strengthen the breathing muscles;

– physical therapy: a gradual progression of loads – from walking to light cardio on an exercise bike;

– psychological support: individual consultations to reduce anxiety levels;

– drug correction: beta-blockers, statins, anticoagulants and supportive anti-cancer therapy.

After 3 months, the patient was able to return to an independent life. Her functional lung capacity increased by 30%, and her ability to exercise reached 70% of the norm for her age. Anxiety decreased significantly, which allowed her to actively participate in rehabilitation programs.

The presented clinical example demonstrates the high effectiveness of modern rehabilitation techniques based on a multidisciplinary approach, early mobilization, personalized treatment and the use of innovative technologies. Successful recovery of patients depends on comprehensive consideration of all aspects of their health and individualization of rehabilitation programs.

The introduction of new methods for monitoring the condition of patients after combined cardio and oncosurgical interventions, such as telemedicine technologies and wearable devices for monitoring health indicators, is becoming a key area of modern rehabilitation medicine [22]. Such innovations significantly expand the possibilities for monitoring patients and adjusting their recovery programs.

Telemedicine provides remote access to professional care, allowing doctors to conduct consultations and monitoring without the need for a personal visit to the clinic. Special applications can transmit data on heart rate, blood pressure, blood oxygen saturation and other important parameters. Mobile apps also help patients monitor exercise performance, monitor exercise frequency, and receive medication reminders. Video consultations with doctors allow timely detection of changes in the patient's condition and prevention of possible complications.

Wearable devices such as smart watches, heart rate monitors, and ECG monitors ensure constant monitoring of the patient's condition. They collect data around the clock, which makes it possible to detect even minor changes in the functioning of the cardiovascular system or respiratory functions. For example, a smartwatch with an ECG function can record an electrocardiogram at any time, which is especially important for patients at risk of developing arrhythmias. Pulse oximeters measure blood oxygen saturation, which is critically important for patients after thoracotomy or lung resection. Pedometers and activity trackers help patients track their physical activity and achieve the targets set by the doctor.

A multidisciplinary rehabilitation program based on close collaboration between cardiologists, oncologists, rehabilitologists, and other specialists is actively developing in the United States. Special attention is paid to the use of telemedicine technologies for remote monitoring of patients' condition. Patients can receive exer-

cise instructions through mobile apps, and their condition is monitored using wearable devices. Research is underway to determine the optimal time to start physical activity after surgery.

European countries are focused on developing rehabilitation standards for this category of patients. Progress is particularly noticeable in Germany and the UK, where experts from these countries are creating common recommendations for risk assessment and rehabilitation program planning. Group psychotherapy programs are being introduced to reduce anxiety and depression.

Japan and South Korea actively use methods based on traditional medicine, such as acupuncture and qigong, which complement Western approaches. In particular, specialists are exploring the possibilities of combining classical rehabilitation with traditional practices to improve the general condition of the patient, and special diets are being developed that take into account the cultural characteristics of nutrition.

International experience in the field of rehabilitation after combined cardio- and oncosurgical interventions demonstrates significant success, but many questions remain open. Promising areas of research include the development of early rehabilitation, the use of digital technologies, the individualization of programs, the improvement of psychological support and the search for optimal combinations of treatment methods. Strengthening international cooperation will accelerate progress in this area and improve the quality of life for patients.

Conclusions

Comprehensive rehabilitation of patients who have undergone combined cardio- and oncosurgical interventions is a complex multi-stage process that requires the integration of various medical disciplines and consideration of many factors. Successful rehabilitation is impossible without the close cooperation of specialists from different fields (cardiologists, oncologists, rehabilitologists, physiotherapists, psychologists and nutritionists). This approach allows you to take into account all aspects of the patient's condition and develop balanced recovery programs.

Each patient has unique characteristics such as age, the severity of the underlying disease, the presence of concomitant pathologies and the general condition of the body. Personalized rehabilitation programs ensure maximum recovery efficiency and reduce the risk of complications.

Early introduction of restorative measures, including breathing exercises, physical activity, and psychological support, helps prevent complications and accelerate the recovery process, which is especially important to minimize the risks of thromboembolic events, pulmonary congestion, and psychoemotional disorders.

Telemedicine technologies and wearable devices allow for continuous monitoring of patients' condition, which increases the safety and accuracy of rehabilitation program adjustments. These tools are becoming an integral part of modern rehabilitation medicine. The psychoemotional state of the patient plays an important role in the success of rehabilitation. Stress, anxiety, and depression can significantly slow down the recovery process. The inclusion of psychological support in rehabilitation programs helps to increase patients' motivation and improve their quality of life. Informing patients and medical staff about the importance of following rehabilitation recommendations contributes to a better understanding of the recovery process and increases the likelihood of successful achievement of rehabilitation goals.

An analysis of international experience shows significant achievements in the field of rehabilitation of this category of patients. However, there are still unresolved issues that require further research, such as the optimal time to start rehabilitation, the use of artificial intelligence to predict complications, and improving program customization methods.

Thus, comprehensive rehabilitation of patients after combined cardio- and oncosurgical interventions requires careful organization, individual approach and the use of modern technologies. The implementation of these principles contributes to achieving better clinical outcomes and improving the overall well-being of patients.

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