DOI 10.26724/2079-8334-2025-4-94-122-126
UDC 616.12-008.331.1-085.844

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COMPARATIVE CHARACTERISTICS OF INPATIENT AND OUTPATIENT CARDIAC REHABILITATION IN PATIENTS AFTER ACUTE CORONARY SYNDROME

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Cardiovascular diseases remain the leading cause of mortality in Ukraine, so effective rehabilitation after acute coronary syndrome is essential for restoring health and preventing repeat events. The purpose of the study was to compare the effectiveness of the inpatient and outpatient stages of cardiac rehabilitation. 60 patients after acute coronary syndrome who underwent various recovery programs were examined. Exercise tolerance, left ventricular ejection fraction, resting heart rate, anxiety level, quality of life, and treatment adherence were assessed. Inpatient rehabilitation improved clinical outcomes and increased therapy adherence, while outpatient rehabilitation contributed to further improvements in physical condition, emotional balance, and quality of life. Combining both stages into a single continuous system provides a sustained rehabilitation effect and increases treatment effectiveness.

Key words: acute coronary syndrome, cardiac rehabilitation, inpatient stage, outpatient stage, treatment adherence.

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ПОРІВНЯЛЬНА ХАРАКТЕРИСТИКА СТАЦІОНАРНОЇ ТА АМБУЛАТОРНОЇ КАРДІОРЕАБІЛІТАЦІЇ У ПАЦІЄНТІВ ПІСЛЯ ГОСТРОГО КОРОНАРНОГО СИНДРОМУ

Серцево-судинні захворювання залишаються провідною причиною смертності в Україні, тому ефективна реабілітація після гострого коронарного синдрому має важливе значення для відновлення здоров'я та запобігання повторним подіям. Метою роботи було порівняти ефективність стаціонарного та амбулаторного етапів кардіологічної реабілітації. Обстежено 60 пацієнтів після гострого коронарного синдрому, які проходили різні програми відновлення. Оцінювали толерантність до фізичного навантаження, фракцію викиду лівого шлуночка, частоту серцевих скорочень у спокої, рівень тривожності, якість життя та прихильність до лікування. Стаціонарна реабілітація покращила клінічні показники та підвищила прихильність до терапії, а амбулаторна сприяла подальшому поліпшенню фізичного стану, емоційного балансу та якості життя. Поєднання обох етапів у єдину безперервну систему забезпечує стійкий реабілітаційний ефект і підвищує ефективність лікування.

Ключові слова: гострий коронарний синдром, кардіологічна реабілітація, стаціонарний етап, амбулаторний етап, прихильність до лікування.

The study is a fragment of the research project "Development of rehabilitation programs by assessing the limitations of functioning and vital activities of vulnerable population groups under martial law", state registration No. 0125U002470.

Acute coronary syndrome (ACS) is the leading cause of mortality in the world and in Ukraine [2, 10].

According to the WHO, about 18 million people die from cardiovascular diseases every year, of which more than 75 % live in middle-income countries [10].

In Ukraine, the mortality rate from ischemic heart disease is 3–4 times higher than the European average [10]. Not only is the prevention and reduction of the risk of acute coronary events a priority in modern cardiology, but the issue of effective rehabilitation of patients who have already suffered such conditions is also becoming increasingly relevant. This is due to the need to restore the cardiovascular system's functional state, improve quality of life, and reduce the risk of recurrent complications and mortality, making rehabilitation measures an integral part of a comprehensive approach to treating ischemic heart disease.

Cardiac rehabilitation is a set of measures aimed at restoring the patient's functional, psychological, and social state after cardiovascular events [2, 3, 9].

According to Anderson L. et al. [3], participation in a cardiac rehabilitation program reduces mortality by 26 % and the risk of recurrent infarction by 20 %. The recommendations of the European Society of Cardiology (ESC, 2021) define cardiac rehabilitation as a mandatory component of secondary prevention [3, 10].

In most developed countries, the recovery process occurs sequentially – from inpatient to outpatient and maintenance stages [2, 5, 9].

However, in Ukraine, the implementation of this system remains incomplete due to financial constraints that prevent patients from receiving both types of care simultaneously. In our realities, the "division" between inpatient and outpatient rehabilitation remains unclearly regulated.

The purpose of the study was to compare the effectiveness of inpatient and outpatient stages of cardiac rehabilitation in patients after acute coronary syndrome and to determine the features of their implementation in the reformed healthcare system of Ukraine.

Materials and methods. The study was conducted in the Department of Rehabilitation and Planned Cardiology of the Municipal Enterprise "Poltava Regional Clinical Medical Cardiovascular Center of the Poltava Regional Council" from January to August 2025. The study selected 60 patients after ACS who were referred for cardiac rehabilitation 2–4 weeks after discharge. The average age was 57.6±6.9 years; men – 68.3 % (n=41), women – 31.7 % (n=19).

The inclusion criteria were: stable condition of patients after ACS, restoration of coronary blood flow by stenting of the infarction-related vessel, absence of multivessel coronary artery disease, optimal drug therapy, and absence of decompensated heart failure or severe arrhythmias. Exclusion criteria included: decompensated heart failure (NYHA functional status III-IV), severe comorbidities that limited the possibility of participating in the rehabilitation program, unstable ischemic heart disease, severe uncontrolled cardiac arrhythmias, cognitive impairment, or patient refusal to participate in the study.

Patients were randomized by simple random sampling into two equal groups of 30 people:

Group I – an inpatient rehabilitation program that lasted for 14 days and included controlled-dose physical activity, breathing exercises, psychological support, and medication optimization. The volume of daily rehabilitation intervention lasted at least 3 hours (high-volume rehabilitation care).

Group II – outpatient rehabilitation program, which lasted 5 weeks, included three physical therapy sessions per week, psychological consultations, and medication support. The volume of rehabilitation intervention on the day of the class lasted at least 1 hour (small-volume rehabilitation assistance).

Drug treatment in both groups was carried out in accordance with the recommendations of the European Society of Cardiology and clinical protocols approved by the Ministry of Health of Ukraine. It did not differ between groups, thereby minimizing its impact on the study results. Patients received standard therapy, which included dual antiplatelet therapy, beta-blockers, statins, angiotensin-converting enzyme inhibitors, or angiotensin II receptor blockers. The drug dosages were adjusted individually, taking into account the clinical condition and treatment tolerability.

To conduct the study, a multi-component rehabilitation model was developed and implemented, which primarily included a multidisciplinary team review (a physician of physical and rehabilitation medicine, a physical therapist, an occupational therapist, a psychologist, and a cardiologist, if necessary). Based on the multidisciplinary team review, the main short- and long-term goals for the rehabilitation period were established, and methods and tools were selected to achieve them.

The multi-component rehabilitation model includes several aspects: education, breathing exercises, physical therapy, medication support, and psychological support.

To assess the effectiveness of inpatient and outpatient rehabilitation, the following parameters were used: 6-minute walk test (6-MWT, m), left ventricular (LV) ejection fraction (Echo, %), resting heart rate (HR) (bpm), anxiety level (HADS), quality of life assessment (SF-36), adherence to medication therapy (Morisky Medication Adherence Scale, MMAS-8), adherence to a healthy lifestyle (Health Behavior Adherence Scale, HBAS), adherence to secondary prevention (Cardiac Rehabilitation Adherence Index (CRAI)) [1, 3, 5, 6, 8].

Mathematical processing of the results was performed using Statistica 8.0 (StatSoft Inc., USA). The mean (M), variance, mean standard deviation, and median (m), probability, and significance levels (p) were calculated. The difference was considered statistically significant ($p < 0.05$).

Written informed consent to conduct the study was obtained from all patients, in accordance with the Declaration of Helsinki of the World Medical Association on the Ethical Principles of Conducting Scientific Medical Research Involving Human Subjects (1964-2008), the European Community Directive 86/609 on the participation of humans in biomedical research, as well as the Order of the Ministry of Health of Ukraine as amended No. 690 dated 23.09.2009. The research protocol was approved by the local bioethics commission under No. 244, dated December 25, 2024.

Results of the study and their discussion. The study analyzed the dynamics of clinical, functional, and psychoemotional indicators in patients after ACS depending on the type of cardiac rehabilitation. Assessment of the effectiveness of inpatient and outpatient rehabilitation programs allowed us to determine their impact on physical performance, hemodynamic parameters, anxiety level, quality of life, and treatment adherence. Table 1 presents a comparative description of the effectiveness of inpatient and outpatient cardiac rehabilitation in the studied patients after ACS.

Table 1

Comparative characteristics of the effectiveness indicators of inpatient and outpatient cardiac rehabilitation

Indicator	Before rehabilitation	Group I (inpatient rehabilitation, n=30)	Group II (outpatient rehabilitation, n=30)	p
6-MWT, m	340±55	405±50	470±60	<0.05
Left Ventricular Ejection Fraction (LVEF), %	48±7	52±6	55±5	<0.05
Resting heart rate, BPM	80±9	73±8	69±6	<0.05
HADS, points	12.4±3.5	9.1±2.8	7.3±2.4	<0.05
SF-36 physical component psychological component (%)	52/49	62/57	72/66	>0.05

After completing the inpatient cardiac rehabilitation program, patients in group I showed a statistically significant improvement in basic hemodynamic parameters. Thus, the left ventricular ejection fraction increased from 48±7 % to 52±6 %, and the resting heart rate decreased from 80±9 to 73±8 beats/min ($p<0.05$). At the same time, exercise tolerance increased: the average distance during the 6-minute walk test increased from 340±55 m to 405±50 m.

The outpatient stage of cardiac rehabilitation was characterized by even more pronounced improvements in functional indicators. In patients in group II, the average 6-MWT distance reached 470±60 m, the left ventricular ejection fraction increased to 55±5 %, and the resting heart rate decreased to 69±6 beats/min ($p<0.05$). The results indicate that the cardiovascular system adapts to prolonged, high-intensity physical exertion during outpatient rehabilitation.

Analysis of the psycho-emotional state showed a decrease in the level of anxiety on the HADS scale in both groups. In the inpatient rehabilitation group, the mean score decreased from 12.4±3.5 to 9.1±2.8, corresponding to a 26 % decrease. In the outpatient rehabilitation group, the level of anxiety decreased to 7.3±2.4 points, which was 41 % of the initial values.

Quality-of-life indicators from the SF-36 questionnaire also showed positive dynamics. In patients after the inpatient stage, the physical component increased from 52 % to 62 %, and the psychoemotional component from 49 % to 57 %. After outpatient rehabilitation, these rates reached 72 % and 66 %, respectively, reflecting significant improvements in patients' functional status and emotional well-being.

After completing the inpatient program, a significant improvement in hemodynamic parameters was observed – an increase in left ventricular ejection fraction from 48±7 % to 52±6 %, a decrease in resting heart rate from 80±9 to 73±8 beats/min, as well as an increase in exercise tolerance in the 6-minute test from 340±55 to 405±5 0 m (Fig. 1).

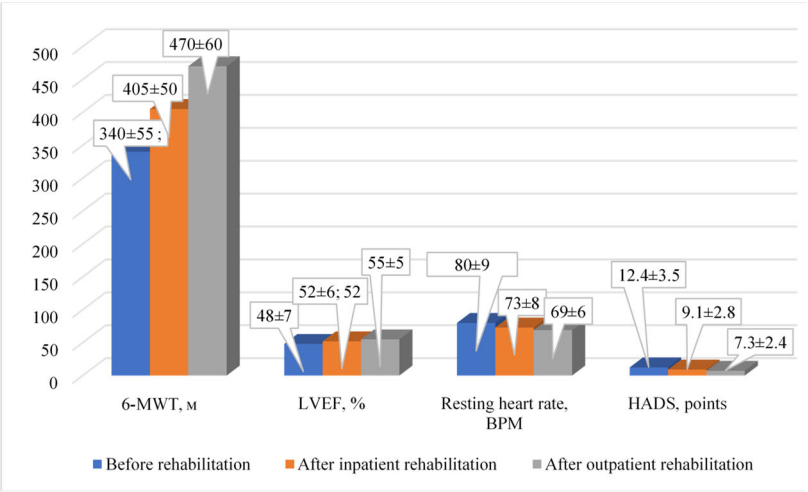

Fig. 1. Comparison of indicators after inpatient and outpatient cardiac rehabilitation.

The outpatient phase, which lasted longer and had a higher intensity of physical and behavioral interventions, demonstrated an even more pronounced improvement in functional status: the average distance in the 6-minute test increased to 470±60 m, the ejection fraction increased to 55±5 %, and the resting heart rate decreased to 69±6 beats/min.

Given the critical role of behavioral factors in the secondary prevention of cardiovascular disease, patient adherence to drug therapy, lifestyle changes, and active participation in the cardiac rehabilitation program were also analyzed. Assessing these parameters enabled us to determine the impact of different stages of rehabilitation not only on the patient's functional state but also on the development of their responsible attitude towards their own health.

A comparative assessment of treatment adherence and behavioral changes in patients after the inpatient and outpatient stages of cardiac rehabilitation is presented in Table 2.

In the inpatient rehabilitation group, the average adherence to medication therapy on the MMAS-8 scale was 7.4±0.8 points, indicating a high level of compliance. In patients in the outpatient group, this

indicator was lower, 6.6±1.1 points ($p<0.05$). A similar trend was observed in adherence to a healthy lifestyle, as measured by the HBAS scale: 82±9 % in group I versus 76±11 % in group II.

Table 2

Comparative assessment of adherence to treatment and lifestyle changes in patients after different stages of cardiac rehabilitation

Indicator	Rating scale	Group I (inpatient rehabilitation, n=30)	Group II (outpatient rehabilitation, n=30)	p
Adherence to drug therapy	MMSA-8, (points, 0-8)	7.4±0.8	6.6±1.1	<0.05
Maintaining a healthy lifestyle (diet, physical activity, quitting smoking)	HBAS (%)	82±9	76±11	<0.05
Active participation in the rehabilitation program	CRAI (%)	79±10	84±8	>0.05
Overall commitment (integral indicator)	-	83±8	80±9	<0.05

At the same time, participation in the cardiac rehabilitation program, as measured by the CRAI scale, was higher in outpatient patients (84±8 %) than in inpatients (79±10 %), reflecting increased autonomy and self-control of patients over the long rehabilitation process.

The results obtained confirm the high effectiveness of cardiac rehabilitation as a key element of secondary prevention in patients after ACS. Both stages – inpatient and outpatient – showed positive dynamics in functional, psycho-emotional, and behavioral indicators, but their impacts went in different directions.

Gradual increases in physical activity and the performance of specially selected breathing exercises contributed to increased tolerance to physical exertion, stabilization of heart rate, and an increase in left ventricular ejection fraction [2, 3]. This approach, applied in both inpatient and outpatient phases, ensured a safe, gradual restoration of physical function.

Breathing exercises are a key tool in restoring the functions of the cardiovascular and respiratory systems after ACS. The use of specially selected breathing techniques (with an emphasis on diaphragmatic breathing, exercises for prolonged inhalation and exhalation) helps improve oxygenation, reduce heart rate, normalize venous return, and increase heart rate variability. Exercises are performed in a sitting or lying position, under the supervision of a physical therapist, with a gradual increase in the duration and depth of breathing. Regular exercise helps reduce shortness of breath, stabilize blood pressure, and reduce anxiety [7, 11]. This method also has a positive effect on the psycho-emotional state, as deep breathing activates the parasympathetic nervous system, reducing stress and tension.

Physical therapy is a key element of cardiac rehabilitation, aimed at gradually restoring physical performance and exercise tolerance and improving hemodynamic parameters. The program is individually adapted to the patient's functional state and includes dosed walking, exercises for large muscle groups, cycling, and coordination exercises. Intensity is determined at 50–70 % of maximum heart rate, with monitoring of saturation and blood pressure. Regular exercise helps lower cholesterol levels, improve glucose metabolism, and increase the efficiency of cardiac output. An essential condition is gradualness and continuity, which ensures safe recovery without the risk of overload. Physical therapy not only improves somatic indicators but also restores the patient's confidence in their own abilities.

Rational drug support, carried out in both groups in accordance with European and Ukrainian recommendations, contributed to the stabilization of hemodynamics and maintenance of the effect of physical and psychological rehabilitation. High rates of treatment adherence (MMAS-8) in the inpatient rehabilitation group confirm the effectiveness of the combined approach, which combines medication management and direct contact with a multidisciplinary team [1, 6, 8].

Psychological support includes individual counseling, group therapy, relaxation training, breathing practices, and cognitive-behavioral techniques. Special attention is paid to working with the family, which helps. This contributed to a reduction in anxiety levels (HADS), improved emotional state, and adaptation of patients to a new lifestyle, as well as maintaining a high level of motivation and adherence to the program. In the first weeks after the event, many patients experience fear of death, depressive thoughts, irritability, and social isolation [11]. reduce anxiety levels and improve social integration. The participation of a psychologist in a multidisciplinary team increases adherence to the program, improves self-esteem, and promotes sustained remission. Effective psychotherapy reduces the risk of recurrent cardiac events and improves quality of life [5, 7, 9].

Educational sessions, conducted mainly during the inpatient stage, helped patients build knowledge of risk factors, self-monitoring principles, and the importance of regular medication intake. This component increased compliance and contributed to the formation of a healthy lifestyle, which is confirmed by high indicators [6, 9].

Thus, the results demonstrate that inpatient cardiac rehabilitation is more effective in promoting adherence to treatment and stabilizing the clinical condition. At the same time, the outpatient program provides more pronounced functional and psychoemotional recovery after acute coronary syndrome.

Limitations of the study include a relatively small sample of patients and a single-center design, which may limit the generalizability of the results. In addition, the duration of follow-up did not allow for the assessment of long-term clinical outcomes of cardiac rehabilitation, particularly the impact on cardiovascular mortality.

Conclusion

Comprehensive cardiac rehabilitation after acute coronary syndrome is an effective tool for restoring the physical, psychological, and behavioral state of patients. Both stages – inpatient and outpatient – provide significant improvement in hemodynamic parameters, exercise tolerance, and quality of life. Inpatient rehabilitation helps stabilize the cardiovascular system, build motivation for treatment, and ensure greater adherence to drug therapy (MMAS-8: 7.4±0.8 points) and a healthy lifestyle (HBAS: 82±9 %). The constant presence of a multidisciplinary team, an educational component, and psychological support builds patient trust in treatment and increases compliance.

Outpatient rehabilitation demonstrates advantages in functional and psychoemotional outcomes: an increase in 6-MWT distance by 38 %, an increase in ejection fraction to 55±5 %, a decrease in heart rate to 69±6 beats/min, and a decrease in anxiety levels (HADS – 7.3±2.4 points).

A long-term program with the patient's independent participation increases physical endurance and quality of life (SF-36 physical component: 72 %; psychoemotional: 66 %).

The level of active participation in the rehabilitation program (CRAI) was higher among outpatient patients (84±8 % vs. 79±10 %), indicating the effectiveness of the gradual return to social activity and self-control.

At the same time, inpatient rehabilitation remains key to fostering behavioral adherence and preventing treatment failure, while outpatient rehabilitation is key to maintaining achieved results and long-term adaptation. The optimal model is their integration into a continuous, multi-component system encompassing educational, physical, medical, and psychological domains.

The prospects of further research. Implementing a single rehabilitation route within the National Health Service of Ukraine's financing framework will increase treatment effectiveness, reduce the risk of recurrent cardiac events, and improve patients' life expectancy after ACS.

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Стаття надійшла 17.10.2024 р.