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REVIEW
ОБЗОРНАЯ СТАТЬЯ

Implementation of a “seamless” model of providing specialized medical care to patients with heart failure

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Abstract. Heart failure (HF) is a widespread disease and tends to increase. Despite the possibilities of modern therapy, the prognosis of patients with HF remains unfavorable. Foreign experience shows that the creation of specialized heart failure clinics improves the quality of care for patients with HF, reduces the frequency of repeated hospitalizations and death of patients. The Russian Federation has gained experience in creating such clinics, in particular, in Nizhny Novgorod, Ufa, St. Petersburg and a number of other cities. The article describes the organization of the work of the Center for HF on the basis of a multidisciplinary hospital in Moscow in period 01.11.2020—01.12.2022. The database included 2,400 patients hospitalized due to acute decompensation of chronic HF (ADCHF). The leading triggers of ADCHF in the studied patient population were an episode of atrial fibrillation/flutter (37 %), low adherence to treatment (25 %) and uncontrolled hypertension (17 %), exacerbation of concomitant diseases (11 %), infection (4 %). In 6 % of patients, the leading trigger could not be identified. The hospital stage included 950 (39.5 %) patients who, in the first 24 hours from the moment of hospitalization, underwent standard physical, laboratory and instrumental examination, including lung ultrasound, NT—proBNP, liver fibroelastometry, VEXUS protocol study, bioimpedance analysis of body composition, of which 496 (20.5 %) people passed the same studies at discharge. In the structure of patients hospitalized with ADCHF who were included in the hospital follow—up stage (n=950), patients with preserved (HFpEF) 42.5 % (n=404) and reduced ejection fraction (HFrEF) prevailed 36 % (n=342), patients with a mildly reduced (HFmrEF) ejection fraction were found in 21.5 %. 1,552 (64.5 %) patients refused additional studies and visits to the CH center, but agreed to outpatient follow—up in the form of telephone contacts. In 370 (15.4 %) patients, contact was lost after discharge. 240 (10 %) patients actively visit the HF center with a comprehensive assessment of congestion and correction of therapy at each visit. Conclusion. There are two stages in the treatment of patients with chronic HF. The first stage

is hospital, the second one is outpatient. It is important not to make omissions in the prescribed drug therapy, which can lead to a fatal outcome. To this end, it is necessary to introduce a "seamless" model of medical care for patients with chronic HF, when the patient comes under the supervision of a multidisciplinary team that carries out timely monitoring.

Key words: heart failure, clinic, specialized care

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Introduction

Heart failure (HF) is the main cause of hospitalization of patients over 65 years of age worldwide [1, 2] and is characterized by a high probability of re-hospitalization and death within the first month after discharge from the hospital. More than 24 % of patients die within 12 months after diagnosis, and mortality reaches 50 % in the next 5 years [3]. According to ORACLE-RF research data, the frequency of repeated hospitalizations for acute decompensation of chronic HF (ADCHF) within 1 month after discharge from the hospital is about ~18—30 %, within 12 months ~69 %-89 % [4, 5], despite all achievements in the treatment of this pathology. The number of patients hospitalized for acute heart failure, mainly of the III—IV functional class, reaches 3 million patients per year according to the EPOKHA-O-CHF study [6]. Repeated episodes of ADCHF lead to progressive disruption of the heart, liver and kidneys, and significantly burden the prognosis [7—10].

In the Russian Federation, chronic heart failure (CHF) is widespread among young people. According to the EPOKHA-CHF study, its frequency in the group of patients aged 30—39 years was 1.6 %, in the group of patients aged 40 to 49 years — 9.4 %. The prevalence of CHF in people aged 50—59 years increases almost 2 times and is 17 % of cases [11]. The frequency of CHF among men under 60 years of age is higher than in women, which may be due to earlier diagnosis of coronary heart disease [12].

HF is a clinical syndrome characterized by typical symptoms and signs caused by structural and/or functional disorders of the heart, leading to a decrease in cardiac output and/ or an increase in intracardiac pressure at rest or during exercise. Decompensation is understood as a rapidly progressive deterioration of signs and symptoms associated with inadequate

perfusion of organs and tissues, as well as with fluid retention in the body in patients with CHF [13–15].

In this regard, one of the main tasks of the cardiological community is to prevent episodes of CHF decompensation. However, at present, despite the success of pharmacological methods of treatment of CHF, its prognosis remains unfavorable — about 30 % of patients die within the first year after diagnosis [16, 17], which leads to a comprehensive approach to the study of HF syndrome, the need for strict control of the course of the disease in outpatient patients and the detection of congestion phenomena. at the prehospital stage, even in the absence of complaints.

The extremely unfavorable prognosis, low survival rate and high frequency of repeated hospitalizations contribute to an increase in the cost of treatment and rehabilitation of these patients. A significant share of the annual costs for the treatment of HF is the cost of the hospital stage of treatment. There is an obvious high need for the introduction of new approaches, one of which is the creation of an expert-level clinic to assist patients with CHF on the basis of existing hospitals, clinical diagnostic centers and primary health care institutions.

An important role in this is played, on the one hand, by improving the quality of medical care and reducing the mortality of patients in the acute period of myocardial infarction, on the other hand, by increasing life expectancy with an increase in the population of elderly patients who develop HF either for natural reasons or as late complications of the underlying disease.

The creation of specialized expert-level centers providing qualified assistance to this category of patients, ensuring a “seamless” transition of the patient from the inpatient to the outpatient stage of treatment of HF, full titration of doses of drugs with proven effectiveness in improving the prognosis of patients with HF, as well as careful monitoring of the degree of elimination of congestion would optimize the management of patients with HF and improve their survival.

One of these clinics is the Heart Failure Center on the basis of a multidisciplinary hospital of the V.V. Vinogradov City Clinical Hospital. The main objectives of the Center are to improve the medical care to patients with HF both on an outpatient and inpatient basis, the introduction into practice of modern methods of diagnosis and treatment of HF, the organization of preventive measures, the maintenance of a patient register.

The structure of the Heart Failure Center is shown in Fig. 1.

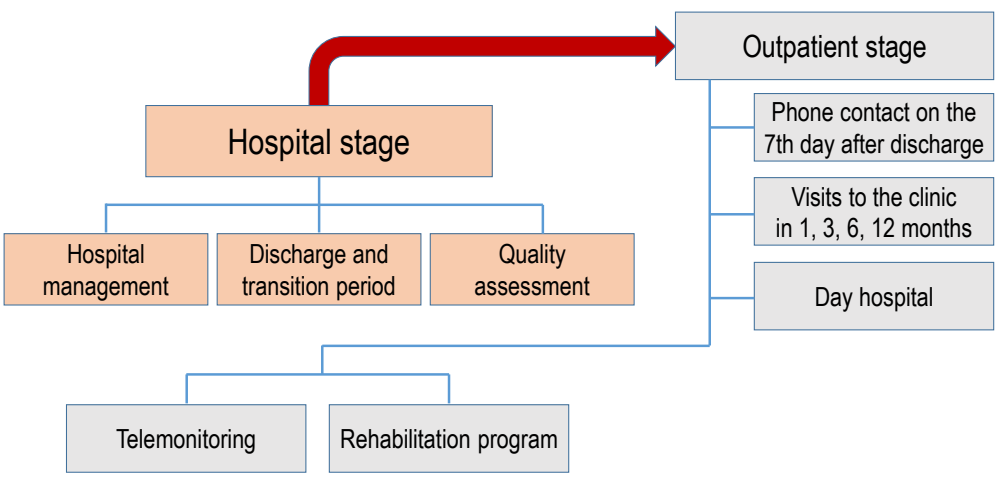

Fig. 1. The structure of Heart Failure Center

A comprehensive program is being conducted on the basis of the HF Center, which includes the following components that allow providing qualified medical care to patients with HF:

• Dynamic monitoring of the patient's condition at the outpatient and hospital stages of management (including monitoring of symptoms of HF and correction of therapy on a regular basis, organization of therapeutic measures when the first signs of decompensation of HF occur);

• Rehabilitation and physical training programs;

• Day hospital programs (outpatient administration of inotropic and diuretic drugs);

• Training and psychosocial support for patients and their families;

• Selection of patients for high-tech methods of treatment (heart transplantation, implantation of pacemakers, cardioverter defibrillators, devices for cardiac resynchronization therapy, revascularization procedures);

• The ability to access clinical trials of new drugs.

The functioning of the HF Center is provided by a multidisciplinary team: the main staff (doctors and nurses trained to provide qualified care to patients with HF), staff with possible part-time employment (nutritionist, physiotherapy specialist, psychologist, social worker), need specialists/consultants (selection of patients for high-tech care), employees of the Information Technology Department technologies.

For a unified approach, standard operating procedures (SOP) have been developed, describing in detail the methods, including: "Itinerary and diagnostic minimum of examination on the first day and on the day of discharge of a patient hospitalized with CHF", "Criteria for hospitalization in the ICU and cardiology department", "Rules for filling in the card of a patient hospitalized with HF", "Protocol of echocardiographic examination of a patient with HF", "Protocol of lung ultrasound of a patient hospitalized with CHF", "Method of conducting the test with a 6-minute walk", "Method of conducting an orthostatic test", "Methods of performing bioimpedance vector analysis (BIVA)", "Methods of performing liver fibroelastometry", "VExUS protocol of a patient hospitalized with ADCHF", "Assessment of depression on the hospital anxiety and depression scale (HADS)", "Structured teaching methodology in the "School of the patient with CH", "Criteria for discharge from the hospital", "Ideal discharge epicrisis", "Structured telephone contact on the 7th day after discharge".

The key components of the hospital stage of care for patients with ADCHF, in addition to a comprehensive assessment of congestion, are the introduction of developed protocols / algorithms of treatment based on the principles of evidence-based medicine, training of medical personnel, structured patient education, provision of written recommendations upon discharge of patients indicating the date, time and place of the follow-up visit / telephone contact.

A characteristic trajectory of the course of HF, even in the case of taking the recommended drug therapy, is the alternation of periods of compensation and decompensation [18]. In addition to the development of decompensation, another point where dissociation between clinical and hemodynamic signs of congestion can be critically significant is the achievement of a euvolemic state during hospitalization and in the early post-hospital period.

It is believed that one of the markers of the success of CHF therapy carried out during hospitalization is the absence of congestion by the time of discharge from the hospital [19]. However, the data of observational studies demonstrate that, firstly, a significant part of hospitalized patients retain symptoms and signs of congestion during discharge, which is naturally associated with an increase in the risk of adverse outcomes, and secondly, even in their absence, the presence of residual congestion detected using various techniques is again associated with an increase in the risk of such adverse outcomes as rehospitalization for HF and death from all causes [20–23]. Therefore, the main task at the hospital stage is to establish contact with the patient, conduct additional non-invasive examination methods to assess the status of hydration. Especially significant is the introduction of the latest techniques for assessing congestion in patients with HF into the practice of urban healthcare.

The number of techniques, the use of which is proposed to characterize congestion in HF, is increasing.

However, in general, all of them can be grouped into four categories: 1. symptoms and signs, as well as scales based on their combination; 2. biomarkers; 3. ultrasound methods; 4. direct assessment of hemodynamic parameters and bioimpedance vector analysis.

Undoubtedly, in practice, physical examination remains the main tool for assessing congestion. However, the accuracy of traditional clinical symptoms and signs of congestion, reflecting an increase in intracardiac filling pressure and/or, as a consequence, excessive accumulation of extravascular fluid, is relatively low compared to the intracardiac assessment of hemodynamics [24]. The NTproBNP assessment is considered the "golden" method of diagnosing HF, and one of the main markers reflecting the severity of congestion and prognosis [25]. Due to the fact that the concentration of NTproBNP itself does not reflect the pathophysiological variants of congestion, ultrasound methods can be used to assess the degree of residual congestion, as well as risk stratification in patients with HF, such as estimating the number of B-lines according to lung ultrasound, assessing liver density by indirect elastometry, assessment of the degree of venous congestion by the diameter of the inferior vena cava (VExUS ("Venous Excess Ultrasound"), as well as assessment of hydration by bioimpedance vector analysis (BIVA), which are widely used in our center (Fig. 2).

Ultrasound examination of the lungs is a new alternative approach to assess congestion in the lungs. Ultrasound of the lungs makes it possible to identify extravascular fluid by visualizing hyperechoic vertical lines (B lines) emanating from the surface of the pleura. Their quantitative assessment makes it possible to measure the degree of pulmonary congestion, facilitates the diagnosis of HF and can be useful for monitoring HF therapy. In addition, B lines provide prognostic value regarding repeated hospitalizations and mortality [26–28].

Indirect liver elastometry is a non–invasive method that has proven itself well and is widely used to determine the presence of severe fibrosis or cirrhosis of the liver and has a high prognostic potential in various liver diseases without HF and with HF [29].

The VExUS study protocol makes it possible to assess venous congestion, taking into account 4 criteria: the diameter of the inferior vena cava (NIP), the shape of the spectrum in the hepatic veins, the shape of the portal vein spectrum, and the shape of the intrarenal vein spectrum [30–32].

Bioimpedance vector analysis (BIVA) is a method based on the assessment of the electrical conductivity of tissues, it is important that the device is manufactured in Russia by Medass company. Conducting this study in patients with CHF allows them to be divided into three groups: dehydration, hyperhydration, and euvolemia. If the patient has no indicators of euvolemia, the BIVA data allow him to be assigned to a group of more thorough monitoring in order to minimize the risks of deterioration of the patient's condition after discharge [33–36].

There are publications in the literature on non-invasive methods for diagnosing hydration status, for example, bedside ultrasound examination POCUS. This technique is used by nephrologists to assess the hydration status of patients. Bedside ultrasound examination (ultrasound examination at the place of medical care — POCUS) becomes an accessible, non-invasive, diagnostic method for an objective assessment of physiological and hemodynamic parameters related to the state of fluid, tolerability and the body's response to therapy. A quick bedside ultrasound assessment will help to obtain qualitative data on the functional state of the heart and quantitative data on pulmonary congestion. The extended POCUS study, which includes Doppler echocardiography, provides additional quantitative information, including flow rate and pressure in the structures of the heart. Recently, abnormal forms of Doppler blood flow in the abdominal organs, secondary to increased pressure in the right atrium, and associated with congestion of organs, bring a new additional component to the assessment of hemodynamics. The joint use of the results of the POCUS study with clinical and laboratory data will help to more accurately assess the hemodynamic status of the patient [37].

In addition, the center has introduced the practice of conducting ultrasound-associated examinations, which are in addition to the general clinical examination in the form of rapid limited ultrasound monitoring for decision-making, performed by doctors of various

clinical disciplines in order to assess the main changes in intracardiac hemodynamics, the structure of lung tissue, the condition of the main arteries and veins, abdominal organs and retroperitoneal spaces [38].

This study does not require professional and advanced training of a specialist in instrumental and radiation diagnostics, a specialized course of study within the framework of the main specialty is sufficient. Ultrasound-assisted examination is not an independent ultrasound. During the examination, the calculation of ultrasound indicators is not performed, a written conclusion in the form of a study protocol is not issued, the data obtained are reflected in the protocol of the initial examination, in the diary. The data of the ultrasound-assisted examination are entered after fixing the parameters of the palpatory examination, percussion and auscultation. The identified changes or their absence are made in any form at the discretion of the doctor who performed the manipulation.

The work of the CH Center from 01.11.2020 to 01.12.2022 was analyzed. The database included 2,400 patients hospitalized due to ADCHF. The hospital stage included 950 (39.5 %) patients who, in the first 24 hours from the moment of hospitalization, underwent standard physical, laboratory and instrumental examination, including lung ultrasound, NT-proBNP, liver fibroelastometry, VEXUS protocol study, bioimpedance analysis of body composition, of which 496 (20.5 %) people passed the same studies at discharge. 238 people (9.9 %) were not included in the hospital stage due to immobilization (n=84), patient refusal (n = 106), or positive polymerase chain reaction for COVID-19 (n = 48), 1212 (50.5 %) patients agreed only to outpatient follow-up in the form of telephone contacts with an assessment of clinical events. 340 (14 %) patients, after a comprehensive assessment of the congestion at admission, further agreed only to outpatient follow-up in the form of telephone contacts. Thus, 1,552 (64.5 %) patients refused additional studies and visits to the CH center, but agreed to outpatient follow-up in the form of telephone contacts. In 370 (15.4 %) patients, contact was lost after discharge. 240 (10 %) patients actively visit the HF center with a comprehensive assessment of congestion and correction of therapy at each visit (Fig. 2).

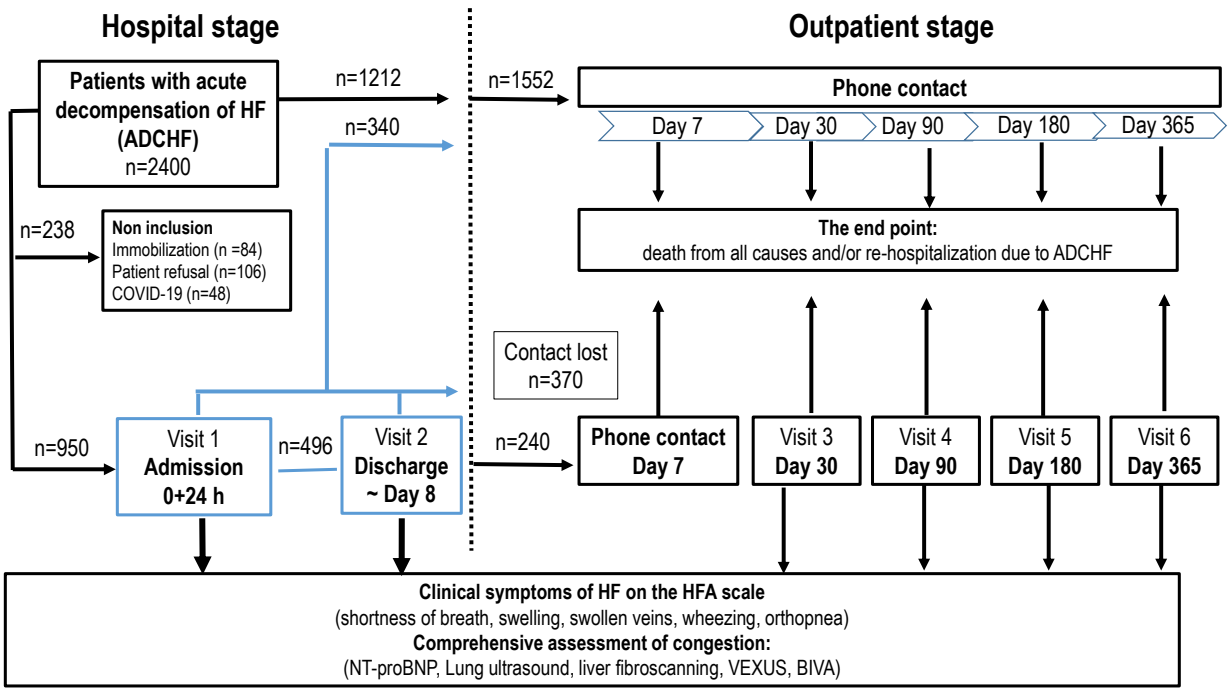

Fig. 2. Design of the work of the CH Center in the period from 01.11.2020 to 01.12.2022

The leading triggers of ADCHF in the studied patient population were an episode of atrial fibrillation/flutter (37 %), low adherence to treatment (25 %) and uncontrolled hypertension (17 %), exacerbation of concomitant diseases (11 %), infection (4 %). In 6 % of patients, the leading trigger could not be identified (Fig. 3).

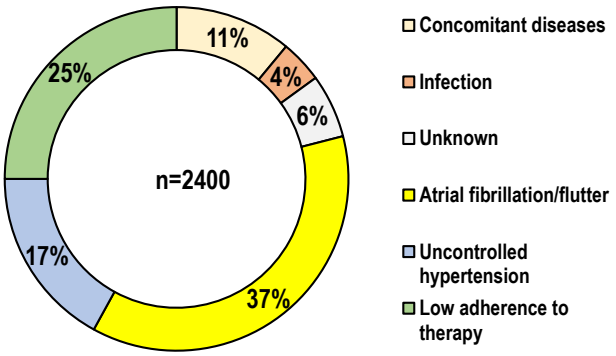

Fig. 3. Triggers of acute decompensation of heart failure.

In the structure of patients hospitalized with ADCHF who were included in the hospital follow-up stage (n = 950), patients with preserved (HFpEF) 42.5 % (n = 404) and reduced ejection fraction (HFrEF) prevailed 36 % (n = 342), patients with a mildly reduced (HFmrEF) ejection fraction were found in 21.5 %. The clinical and demographic characteristics of the patients included in the hospital stage are presented in Table 1.

Patients with HFrEF was characterized by higher frequency of coronary heart disease and a history of myocardial infarction, as well as atrial fibrillation and smoking. A higher incidence of obesity, arterial hypertension (AH) and type 2 diabetes mellitus (DM) was observed in the group of patients with HFpEF.

Table 1.

Clinical and demographic characteristics of patients included in the hospital stage (n=950)

Parameter	Total group (n = 950)	HFrEF (n = 342)	HFmrEF (n = 204)	HFpEF (n = 404)
Gender (male/female), n (%)	526 (55,3 %)/ 424 (44,7 %)	237 (69,2 %) /105 (30,8 %)	110 (53,9 %)/ 94 (46,1 %)	179 (44,3 %) /225 (55,7 %)
Age, years (M ± SD)	70,72 ± 12,85	66,7 ± 13,3	71,8 ± 12,0	73,62 ± 11,95
BMI, kg/m2, (M ± SD)	32,2 ± 7,3	31,1 ± 6,9	32,5 ± 6,8	32,9 ± 7,7
Obesity, n (%)	547 (57,5 %)	181 (52,9 %)	120 (58,8 %)	246 (60,8 %)
Smoking, n (%)	226 (23,7 %)	104 (30,4 %)	40 (19,6 %)	82 (20,2 %)
Arterial hypertension, n (%)	864 (90,9 %)	301 (88,0 %)	193 (94,6 %)	370 (91,5 %)
History of stroke, n (%)	136 (14,3 %)	43 (12,5 %)	28 (13,7 %)	65 (16,0 %)
Coronary heart disease, n (%)	495 (52,1 %)	207 (60,5 %)	105 (51,4 %)	183 (45,2 %)
History of myocardial infarction, n (%)	356 (37,4 %)	170 (49,7 %)	80 (39,2 %)	106 (26,2 %)
Coronary artery bypass grafting, n (%)	48 (5,0 %)	20 (5,8 %)	16 (7,8 %)	12 (2,9 %)
Percutaneous intervention, n (%)	161 (16,9 %)	70 (20,4 %)	39 (19,1 %)	52 (12,8 %)
Implantable devices, n (%)	64 (6,7 %)	21 (6,1 %)	13 (6,3 %)	30 (7,4 %)
Atrial fibrillation/flutter, n (%) • Paroxysmal form • Permanent form	610 (64,2 %) 268 (28,2 %) 342 (36,0 %)	214 (62,5 %) 97 (28,3 %) 117 (34,2 %)	155 (75,9 %) 68 (33,3 %) 87 (42,6 %)	241 (59,6 %) 103 (25,4 %) 138 (34,2 %)
Diabetes mellitus 2 type, n (%)	313 (32,9 %)	97 (28,3 %)	71 (34,8 %)	145 (35,8 %)
Chronic kidney disease, n (%)	173 (18,2 %)	62 (18,1 %)	35 (17,1 %)	76 (18,8 %)
Anemia, n (%)	201 (21,1 %)	62 (18,1 %)	42 (20,5 %)	97 (24,0 %)
COPD/bronchial asthma, n (%)	173 (18,2 %)	62 (18,1 %)	36 (17,6 %)	76 (18,8 %)

Note: BMI — body mass index; COPD — chronic obstructive pulmonary disease; HFrEF — heart failure with reduced ejection fraction.

In addition to the hospital stage, where CHF therapy is initiated, the stage of further outpatient follow-up is important, where one of the main tasks is to achieve the target doses of the drug treatment and control the subsequent condition of the patient. This is a relatively little-studied area. Patients with HF, even if the symptoms are well controlled and stable, need to be monitored to ensure further optimization of therapy, to identify asymptomatic progression of HF or concomitant diseases, as well as to discuss new advances in treatment.

The outpatient stage provides for visits to the clinic, structured telephone support, rehabilitation programs (Fig. 2). Assessment of long-term clinical events is carried out by structured telephone interview 7 days, 1, 3, 6, 12, months after discharge and then once a year. The primary events are composite points of total mortality and repeated hospitalizations.

The results of the observation of patients with HF participating in the outpatient stage of observation were analyzed. Total mortality was 12.6 % (n = 226) during 2 years of follow-up. 214 patients died in the group of telephone contacts and 12 in the group of visits to the center from the total 1792 patients of the outpatient stage.

In a meta-analysis involving 53 randomized trials published in 2017, the authors concluded that both HF clinics and nurses' home visits to patients reduce mortality from all causes, while home visits were the most effective [39]. In another meta-analysis, which included 20 studies involving 5,624 patients, it was shown that active intervention aimed at increasing self-control in patients with HF improves the results of therapy [40].

Conclusion

Thus, there are two stages in the treatment of patients with chronic HF. The first stage is hospital, where it is necessary to initiate therapy. Taking into account the important economic component of patients with chronic HF and the reduction of hospitalization time, the second important stage is outpatient. The stage of discharge of the patient is the most "subtle", when the patient must continue the treatment started. It is important not to make omissions in the prescribed drug therapy, which can lead to a fatal outcome. To this end, it is necessary to introduce a "seamless" model of medical care for patients with chronic HF, when the patient comes under the supervision of a multidisciplinary team that carries out timely monitoring.

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Реализация «бесшовной» модели оказания специализированной медицинской помощи пациентам с сердечной недостаточностью

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Аннотация. Сердечная недостаточность (СН) является широко распространенным заболеванием и имеет тенденцию к увеличению. Несмотря на возможности современной терапии прогноз пациентов с СН остается неблагоприятным. Зарубежный опыт показывает, что создание специализированных клиник сердечной недостаточности улучшает качество оказания помощи больным с СН, снижает частоту повторных госпитализаций и смерти больных. В Российской Федерации появился опыт создания таких клиник, в частности в Нижнем Новгороде, Уфе, Санкт-Петербурге и ряде других городов. В статье описана организация работы Центра по СН на базе многопрофильного стационара в г. Москва с 01.11.2020 по 01.12.2022 гг. В базу данных было включено 2400 пациентов, госпитализированных в связи с острой декомпенсацией хронической СН (ОДХСН). Показано, что ведущими триггерами ОДХСН в исследуемой популяции пациентов являлись эпизод фибрилляции/трепетания предсердий (37 %), низкая приверженность к лечению (25 %) и неконтролируемая

артериальная гипертония (17 %), обострение сопутствующих заболеваний (11 %), инфекция (4 %). У 6 % пациентов ведущий триггер выделить не удалось. В госпитальный этап были включены 950 (39,5 %) пациентов, которым в первые 24 часа от момента госпитализации, проводили стандартное физическое, лабораторное и инструментальное обследование, включая УЗИ легких, NT — proBNP, фиброэластометрию печени, исследование по протоколу VEXUS, биоимпедансный анализ состава тела. Из 950 пациентов 496 (20,5 %) человек прошли те же исследования при выписке. В структуре пациентов, госпитализированных с ОДХСН, которые были включены в госпитальный этап наблюдения (n = 950), преобладали пациенты с сохранной 42,5 % (n = 404) и низкой фракцией выброса 36 % (n=342), пациенты с умеренно низкой фракцией выброса встречались в 21,5 %. 1552 (64,5 %) пациента отказались от дополнительных исследований и визитов в центр СН после выписки, однако дали согласие на амбулаторное наблюдение в виде телефонных контактов. У 370 (15,4 %) пациентов после выписки контакт был утерян. 240 (10 %) пациентов активно посещают центр СН с проведением комплексной оценки застоя и коррекции терапии на каждом визите. *Выводы*. При терапии пациентов с хронической СН выделяют два этапа. Первый этап — госпитальный, второй — амбулаторный. Важно не допускать пропусков в назначенной медикаментозной терапии, что может привести к летальному исходу. С этой целью необходимо внедрить «бесшовную» модель оказания медицинской помощи больным с хронической СН, когда пациент поступает под наблюдение многопрофильной бригады, осуществляющей своевременное наблюдение.

Ключевые слова:сердечная недостаточность, клиника, специализированная помощь

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