SCHOLASTIC:
Journal of Natural and Medical Education
Volume 2 Issue 4, Year 2023 ISSN: 2835-303X
https://univerpubl.com/index.php/scholastic

Assessment of Intracardiac Hemodynamic Parameters Before and After Treatment for Chronic Heart Failure in Comorbidity Conditions

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Article Information

Received: February 16, 2023
Accepted: March 17, 2023
Published: April 18, 2023

Keywords: *Chronic heart failure, diabetes mellitus, chronic kidney disease, inhibitor sodium/glucose cotransporter 2 (SGLT-2) dapagliflozin.*

ABSTRACT

In this scientific work, the functional state of the heart was evaluated using echocardiography in patients with chronic heart failure of functional class II and III with concomitant pathology with and without diabetes mellitus and chronic kidney disease of stage C2 and C3a developed on their basis. The positive effect of therapy containing angiotensin converting enzyme inhibitors (ACE inhibitors or angiotensin receptor antagonists (ARA), beta-blockers, mineralocorticoid receptor antagonists (MRA) -veroshpiron, according to indications antiarrhythmic, anticoagulant and diuretic agents, as well as complex treatment with the addition of a inhibitor sodium/glucose cotransporter 2 (SGLT-2) dapagliflozin and ethylmethylhydroxypyridine succinate (mexidol). Significant (R<0.001) positive changes in intracardiac hemodynamics, including left ventricular ejection fraction, were observed in both groups before and after complex treatment.

Introduction

Despite the widespread use in the practice of drugs that have been proven to be effective in ham, advances in studies on the pathogenesis and course of chronic heart failure (CHF), it remains the final stage of the cardiovascular continuum. It is considered one of the important treatments of medicine due to the fact that the disease is widespread and develops and ends up with unpleasant consequences [4, 11,14].

In studies from recent years, CHF has been noted that high comorbidity in existing patients decreases their quality of life, leading to impaired social adaptation and increased mortality. According to some data, the incidence of comorbidity reaches 69% at the age of 18-44 years, 93% at 45-64 years, and 98% in those over 65 years of age [12].His many encounters and increasing numbers are indicative of the need to study this problem for Uzbekistan, among others [1,2,3].

In many cases, CHF and chronic kidney disease (CKD) have a dramatic negative impact on life expectancy, occurring in comorbidity. It is increasingly common that these conditions are accompanied by diabetes mellitus (DM) or that severe complications that have been reported develop at its base. For this reason, the study of comorbid conditions cited, early diagnosis, effective treatment of prevention are important practical.

In countries all over the world, including our republic, the number of elderly people is increasing due to the prolonged life expectancy of the population. Naturally, in parallel with their increase in society, an increase in the number of patients suffering from CHF is also noted. Comorbid conditions should be considered when treating them [5,6,7].

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In this context, selective inhibitors of sodium glucose type 2 co-transporter (SGLT-2) have been widely used in recent years as part of CHF's standard treatment. A representative of SGLT -2 selective inhibitors conducted separate DAPA-HF subtahlili in patients with the aim of assessing the effectiveness and safety of dapagliflozin in relation to age [8,15].

The cardioprotective effect of dapagliflozin is manifested by a decrease in body weight, decreased blood pressure, albuminuria, slowdown in vascular remodeling, improved capillary blood flow,endothelial activity, decreased secretion of proinflammatory cytokines, infiltration of vascular walls with macrophages, slowing down fibrosis processes in the heart, kidneys and liver due to reduced inflammatory – oxidative stress[9,10,13].

The purpose of the study

The study of the effect of SGLT -2 selective inhibitors-dapagliflozin on cardiac hemodynamics in chronic kidney disease, in which chronic heart failure develops at the base of them in comorbidity with diabetes mellitus and without diabetes mellitus.

Source and methods of research

Based on the goal set before us, 80 patients were involved in scientific research work with CHF diabetes mellitus in comorbidity and without it, and at the base of which there is an advanced stage СЛВ S2 and S3a. There were 43 (53.75%) males and 37 (46.25%) females. The monitored patients were in turn classified into two groups, consisting of patients with CHF+diabetes (40 patients) and CHF + diabetes-free (40 patients). The standard treatment for either group are angiotensin-converting enzyme inhibitors (angiotensin converting enzyme inhibitor (ACEi) or angiotensin receptor antagonists (ARA), β-blockers, mineralocorticoid receptor antagonists (MRA)-veroshpiron, based on indications of antiarrhythmic, anticoagulant and diuretics) sodium glucose co-transporter type 2 (SGLT-2) inhibitors dapagliflozin (forsiga) as well as ethylmethylhydroxypyridine succinate (mexidol) preparations were prescribed.

In turn, each group was allocated to two II and III FC, respectively, to the CHF functional classes (FC). The clinical classification of observational patients is given in Table 1.

Table 1. Clinical classification of patients involved in the study

Specification	Main group			
	Chronic heart failure with diabetes n=40		Chronic heart failure without diabetes n=40	
	number	%	number	%
Men	19	47,5	24	60
Women	21	52,5	16	40
FC II	20	50	20	50
FC III	20	50	20	50
IHD. post-infarction cadiosclerosis	25	62,5	23	57,5
Hypertension	28	70	32	80
Obesity	13	32,5	16	40
Anemia	22	55	24	60
Median age	64,9±1,48		62,6±1,4	
Note: the number of patients in the table is higher than the number involved in the study due to the fact that one patient in our observation was sometimes diagnosed with two or more diseases.				

In patients involved in the study, CHF's diagnosis and its functional classes were determined based on their complaints, anamnesis, objective examination, and laboratory – asbobium

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examinations according to the criteria of the New York Society of cardiologists (New York Heart Association, 1964).

The diagnosis of diabetes mellitus was made in all cases after confirmation with the help of appropriate laboratory tests, on the advice of an endocrinologist. The follow-up received patients with type 2 diabetes mellitus with a duration of the disease of 3 or more years. During the observation, they were regularly observed from the side of the endocrinologist, and on their recommendation, hypoglycemic treatment was carried out.

All patients were tested for all – clinical-general blood and forehead analysis (overnight albuminuria), blood sugar levels, biochemical – liver transferases, bilirubin, mochevina, creatinine, cystatinine- C, blood lipid spectrum, coagulogram, interleukin-6 (IL-6), TGF-β1 as well asbobium– ECG, ExoCG before and after 6 months of treatment. All patients were prescribed standard treatment β-blockers, ACEi or ARA and MCA, and the drug SGLT-2 inhibitors dapagliflozin (forsiga) and ethylmethylhydroxypyridine succinate (mexidol) in addition to standard treatments, based on the recommendation of the European Society of cardiologists in 2021 for 6 months.

Echocardiography**.** (EchoCG) inspection was carried out in transthoracic style on PHILIPS Affinity 70 equipment (Germany), sector ili s 5-1 mgs li sensor. It was conducted in accordance with the recommendations of the American exocardiography Association (ase, 2015) in various cases of the patient, M and V procedures, in order to ensure that the structural integrity of the heart is clearly manifested in it. The examination revealed the following indicators: the last diastolic and systolic size of the left ventricle (LDS and LSS), the last diastolic and systolic volume (LDV and LSV), the thickness of the left ventricular back wall (LVBW) and the inter - ventricular barrier thickness, the left compartment measurement, the Simpson method left ventricular blood-firing fraction (BFF), the shock size (ss) - the difference between SDH and SSH, R. B. Using the Devereux formula, the left ventricular myocardial weight (LVMW) was calculated.

The following table 1 provides data on exocardiography indicators conducted in Group A and Group B patients involved in the study.

Table 1. Indications of intra-cardiac hemodynamics identified using exocardiography in patients with chronic heart failure II-III functional class diabetes mellitus and diabetes mellitus.

№	Pointers	Group A, CHF II - III FC diabetes mellitus is present (n=40)		Group B, CHF II-III FC diabetes-free (n=40)	
		CHF FC II (n=20)	CHF FC III (n=20)	CHF FC II (n=20)	CHF FC III (n=20)
1	Left ventricular end systolic size (26-38 mm), mm	45,3±1,8	50,35±1,6	42,6±1,2	46,9±1,5
2	Left ventricular end diastolic size (44-54 mm), mm	64,4±1,6*	69.35±1,5*	59,9±1,2	65.3±1,2
3	Left ventricular end diastolic volume (88-145 ml), ml	178,3±7,7	203,9±7,9	174,6±4,1	192,3±6,8
4	Left ventricular end sistolic volume (45-68	97,3±5,2*	112,3±9,1	83,15±3,4	104,15±8,1

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	ml), ml				
5	Left ventricular blood throw fraction, %	42.1±1,2*	36,5±0,9**	46.2±1,0	41,7±1,3
6	Left ventricular myocardial weight, g	233,5±4,4*	247.5±6,2	220,3±3,9	240.9±5,5
Note: * - reliability of pre-treatment indication difference:* - p<0,05., ** - p<0,01.					

As presented in the table, left ventricular end systolic size was 45.3±1.8 mm and 50.35±1.6 mm in Group A patients at CHF II and III FC, respectively, and 42.6±1.2 mm and 46.9±1.5 mm in Group B, and no reliable differences were found when they were studied in comparison (R>0.05). The diastolic size of the left ventricle was 64.4±1.6 mm and 59.9±1.2 mm in patients with Group A as well as Group B CHF'S II FC, and 69.35±1.5 mm and 65.3±1.2 mm respectively in patients with CHF'S III FC, and a reliable difference was recorded (R<0.05). The left ventricular end diastolic volume was found to be 178.3±7.7 ml and 203.9±7.9 ml respectively in CHF II and III FC in the first group of patients, and no reliable differences were observed in the second group at 174.6±4.1 ml and 192.3±6.8 ml (R>0.05). A reliable difference was noted in left ventricular end systolic volume CHF II FC present in a as well as Group B patients of 97.3±5.2 ml and 83.15±3.4 ml respectively (R<0.05). In patients with CHF's III FC, no reliable difference was observed between the two groups of pointers (112.3±9.1 ml and 104.15±8.1 ml, R>0.05, respectively).

Left ventricular blood firing fraction (LVBFF) DM was 42.1±1.2% in existing CHF II FC patients, 46.2±1.0% in CHF II FC patients lacking DM, and a reliable difference was found (R<0.05). In patients with CHF's III FC, however, a high reliable difference was reported in both groups of 36.5±0.9% and 41.7±1.3% respectively (R<0.01). The myocardial weight of the left ventricle was 233.5±4.4 g and 247.5±6.2 g in Group A patients at CHF's II and III FC, respectively, and 220.3±3.9 g and 240.9±5.5 g in Group B, and a reliable difference was found in patients with II FC when compared (R<0.05).

The development of fibrosis processes in the myocardium leads to hypertrophy, remodeling and dilation of the left ventricle, causing a violation of its geometry, as a result of which systolic and diastolic dysfunction of the left ventricle occurs [154; P.356-67; 18; P.488-94].

Analysis performed observed negative changes in CHF's comorbid state, including those that did not have DM in their intra-cardiac hemodynamic displays in line with its FC when accompanied by DM. These were evident in left ventricular end diastolic size, end systolic size, myocardial weight, and blood firing fraction.

Research results

Table 2. Comparative analysis of indications of intra-cardiac hemodynamics after standard treatment procedures of various contents in patients with chronic heart failure functional class II diabetes mellitus and diabetes-free.

№	Pointers	Group A, CHF II FC diabetes is present (n=20)		Group B, CHF II FS diabetes-free (n=20)	
		Before treatment	After treatment	Before treatment	After treatment
1	Left ventricular end systolic size (26-38 mm), mm	45,3±1,8	40,6±1,6	42,6±1,2	38,4±1,3*
2	Left ventricular end diastolic size (44-54 mm),	64,4±1,6	58,9±1,2*	59,9±1,2	55,6±1,4*

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	mm				
3	Left ventricular end diastolic volume (88-145 ml), ml	179,3±6,0	155,6±4,0**	174,6±4,1	162,6±3,9*
4	Left ventricular end sistolic volume (45-68 ml), ml	97,3±5,2	80,0±3,3**	83,15±3,4	76,3±3,1
5	Left ventricular blood throw fraction, %	42.1±1,2	48.4±1,1***	46.2±1,0	51,2±1,1**
6	Left ventricular myocardial weight, g	233,5±4,4	218,3±3,9*	220,3±3,9	206,8±4,2*
Note: * - reliability of pre-treatment as well as subsequent indication difference: * - p<0,05., ** - p<0,01., *** - p<0,001.					

As presented in the table, the systolic size of the left ventricle was 45.3±1.8 mm and 40.6±1.6 mm, respectively, before and after treatment in patients receiving CHF standard treatment+dapagliflozin (forsiga) and ethylmethylhydroxypyridine succinate (mexidol). In the second, i.e. only group that received a standard treatment, however, this indicator decreased from 42.6±1.2 mm to 38.4±1.3 mm and a reliable difference was recorded (R<0.05). The left ventricular end diastolic size change was reliable in both groups of patients after treatment (decreased from 64.4±1.6 mm to 58.9±1.2 mm and from 59.9±1.2 mm to 55.6±1.4 mm, R<0.05) The final diastolic and systolic volume of the left ventricle was 179.3±6.0 ml and 97.3±5.2 ml respectively before treatment in the first major group, 155.6±4.0 ml and 80.0±3.3 ml after treatment. When they were studied in comparison, High reliable differences were noted (R<0.01). In the second main group, only the final diastolic volume was reliably reduced after treatment (from 174.6±4.1 ml to 162.6±3.9 ml, R<0.05).

The left ventricular blood-firing fraction increased from 42.1±1.2% in the first group after treatment to 48.4±1.1% by 1.15 times, with a high-fidelity (R<0.001) difference observed, while the second group increased from 46.2±1.0% to 51.2±1.1%, and an average high-fidelity difference was recorded (R<0.01).Left ventricular myocardial weight decreased reliably in both groups (R<0.05).

In Table 3 below, CHF III FC is a comparative study of post-treatment exocardiography indications in patients.

Table 3. Comparative analysis of indications of intra-cardiac hemodynamics after standard treatment procedures of various contents in patients with chronic heart failure functional class III diabetes mellitus and diabetes-free.

№	Pointers	Group A, CHF II FC diabetes is present (n=20)		Group B, CHF II FS diabetes-free (n=20)	
		Before treatment	After treatment	Before treatment	Before treatment
1	Left ventricular end systolic size (26-38 mm), mm	50,35±1,6	45,2±1,5*	46,9±1,5	42,4±1,3*
2	Left ventricular end diastolic size (44-54 mm), mm	69.35±1,5	63,2±1,2**	65.3±1,2	60,2±1,1**
3	Left ventricular end diastolic volume (88-145	203,9±7,9	178,4±6,8*	192,3±6,8	174,6±6,6

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	ml), ml				
4	Left ventricular end sistolic volume (45-68 ml), ml	112,3±9,1	89,6±8,1*	104,15±8,1	80,2±7,2*
5	Left ventricular blood throw fraction, %	36,5±0,9	44,8±1,2***	41,7±1,3	47,2±1,2**
6	Left ventricular myocardial weight, g	246.75±6,2	230.2±5,5	240.9±5,5	221.2±5,3*
Note: * - reliability of pre-treatment as well as subsequent indication difference: * - p<0,05., ** - p<0,01., *** - p<0,001					

Changes in left ventricular end systolic size following the procedures performed were more reliable in both groups of patients (R<0.05). The left ventricular end diastolic size was 69.35±1.5 mm before treatment in the first group and 63.2±1.2 mm after treatment, 65.3±1.2 mm and 60.2±1.1 mm respectively in the second group. Higher reliable differences were noted when the changes in the two groups were compared (R<0.01). In the first group, the left ventricular end diastolic volume decreased from 203.9±7.9 ml to 178.4±6.8 ml (R<0.01). In the second group, however, the changes were not reliable (decreased from 192.3±6.8 ml to 174.6±6.6 ML, R>0.05). Left ventricular end systolic volume decreased by 1.3 career after treatments in both groups and reliable differences were observed (R<0.05). The left ventricular blood-firing fraction increased from 36.5±0.9% to 44.8±1.2% after treatment in the first group, recording a high reliable difference (R<0.001). The second group increased from 41.7±1.3% to 47.2±1.2% and a reliable difference was found (R<0.01). Left ventricular myocardial weight decreased 1.07 times in patients receiving standard treatment+dapagliflozin (forsiga) and ethylmethylhydroxypyridine succinate (mexidol), but the changes were not reliable (only in patients receiving standard treatment the difference was reliable after treatment (decreased from 240.9±5.5 g to 221.2±5.3 g, R<0.05). So, judging by the results obtained, a complex treatment with dapagliflozin + and ethylmethylhydroxypyridine succinate (mexidol) in the composition led to the stabilization of fibrosis processes in patients. This was especially evident in patients with diabetes mellitus at the base of CHF II-III FC.

Summary

Before and after complex treatments performed in comorbidity with chronic heart failure diabetes mellitus intra-cardiac hemodynamics, including left ventricular hemorrhagic fraction, positive changes were observed in FS II and III of the disease from 42.1±1.2% to 48.4±1.1%, from 36.5±0.9% to 44.8±1.2% with high reliability (R<0.001). In patients without QD, the rates were 46.2±1.0% and 51.2±1.1% in II FS, 41.7±1.3% and 47.2±1.2% in III FS (r<0.01).

Analysis performed observed negative changes in CHF's comorbid state, including those that did not have DM in their intra-cardiac hemodynamic displays in line with its FC when accompanied by DM. These were evident in left ventricular end diastolic size, end systolic size, myocardial weight, and blood firing fraction.

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