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Arterial Hypertension - the Main Risk Factor for the Development of Chronic Heart Failure

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Abstract
Arterial hypertension, in combination with itself or coronary artery disease, can come before the development of heart failure. The Framingham study showed that hypertension is a major risk factor for the development of heart failure. Hypertension is not the only factor that contributes to the development of heart failure. Heart failure syndrome is the result of several systemic reactions, and the development of heart failure is a complex and progressive process associated with cardiovascular diseases caused by risk factors: hypertension, obesity, smoking and dyslipidemia. Arterial hypertension is the main harbinger of left ventricular hypertrophy. Initially, this process causes diastolic dysfunction in the early stages of primary arterial hypertension. Systolic dysfunction is rare in these patients. Left ventricular hypertrophy is also an important risk factor for myocardial infarction and ventricular arrhythmias. Asymptomatic systolic and diastolic dysfunction of the left ventricle can clearly progress to HF
Primary prevention of patients with heart failure should be based on strategies that ensure strict and stable blood pressure control. This therapy should include a means that inhibits the renin-angiotensin-aldosterone system. Treatment of arterial hypertension in patients with HF should take into account the main type of cardiac dysfunction — diastolic or systolic.

Keywords: arterial hypertension, chronic heart failure, left ventricular hypertrophy, renin-angiotensin-aldosterone system, systolic dysfunction, diastolic dysfunction.

Introduction

Arterial hypertension is a risk factor for chronic heart failure (CHF) and leads to the development of left ventricular hypertrophy. Arterial hypertension is a risk factor for coronary artery disease (CAD). The relative risk of developing CHF in patients with hypertension compared to the general population was estimated at 1.4 in the first national health and Nutrition Survey Analysis [1]. In addition, patients with CHF may have arterial hypertension. In the general population, people with arterial hypertension have a worse prognosis than normotensive individuals. Unlike the pattern observed in

the general population, high blood pressure before treatment begins is a good indicator of survival in patients with CHF.

Hypertension and CHF are the main health problems in developed countries. Arterial hypertension is the most important modifiable risk factor for the development of CHF [2].

In recent decades, the incidence, prevalence, and overall mortality rate of CHF has increased, and the incidence and mortality from CHD and stroke have consistently decreased.

Arterial hypertension is a disease of the cardiovascular system, which is manifested primarily by a chronic increase in blood pressure above 140/90 mm HG at rest. and may be associated with the development of myocardial disease, that is, cardiomyopathy. CHF is a clinical syndrome that manifests itself in the late stages of cardiomyopathy. As the main cause of heart failure associated with hypertension, hypertensive heart disease and hypertonic cardiomyopathy are associated with increased load on the heart. Hypertension rarely occurs without other risk factors and joint diseases. In addition to gender, these factors include genotype, body size, coronary artery disease, diabetes, obesity, and alcohol consumption. Arterial hypertension is an important factor in the development of multiple cardiomyopathy.

2. Epidemiology

The Framingham heart Study found that arterial hypertension alone or in combination with CAD precedes the development of CHF in 70% of men and women [3,4]. Arterial hypertension was the most common cause of CHF between the ages of 30 and 62. CHF is six times more common in people with arterial hypertension than in normotensive patients. Participants in the Framingham Heart Study and Framingham Offspring Study, which began in 1970, reported only the transition from arterial hypertension to hypertension with CHF. The risk of developing CHF in people with hypertension is twice that in men, and in their free time it is adjusted to the age and Risk Factors of developing CHF compared to normotensive subjects in women [5]. The five-year survival rate for CHF with hypertension was 24% in males and 31% in females.

The risk of developing CHF in people with Arterial hypertension depends on the level of arterial hypertension, that is, the value of blood pressure. Before CHF, isolated systolic hypertension often occurs. Arterial hypertension is highly prevalent in the group of elderly CHF patients, where secondary CHF after arterial hypertension is often associated with left ventricular systolic function [6]. Left ventricular systolic function is maintained in CHF up to 50% of all HF cases in adults over 65 years of age. In the Helsinki aging study, 72% of patients with CHF had normal systolic function. Diastolic HF was identified in 51% of patients and hypertension was responsible for CHF in 54% of subjects [7].

Some comorbidities contribute to the development of multiple cardiomyopathy: CAD, diabetes, and alcohol consumption. In the Framingham Study, myocardial infarction,

diabetes mellitus, left ventricular hypertrophy, and heart valve defect were predictors of the development of CHF in people of both sexes with hypertension. Basically, the relationship of diabetes and arterial hypertension with CHF exceeds expectations of any of them [8,9].

3. Cardiovascular continuity-from arterial hypertension to chronic heart failure.

CHF syndrome is the result of several systemic reactions. In the early stages of Arterial hypertension, the structure and function of the left ventricle are normal. Over time, the pathological effects of one or more risk factors are restored, which leads to the development of functional and structural changes with left ventricular hypertrophy (LVH) and myocardial infarction (MI). This leads to the development of diastolic and systolic dysfunction, which leads to heart failure [10].

Arterial hypertension has been identified as a major harbinger of left ventricular hypertrophy. Patients with mild hypertension have a two to three times higher risk of developing hypertrophy than normotensive patients. The development of cardiac hypertrophy is associated with degenerative changes in cardiac myocytes and abnormal accumulation of collagen in interstitial spaces. These phenomena initially cause diastolic dysfunction. The presence of LVH is also an important risk factor for its development. Several observational studies have shown a significant, level, and strong correlation between blood pressure and the frequency of coronary events [11]. Pathological changes that occur after it are characterized by a restructuring of the left ventricle, which increases in the presence of arterial hypertension.

Asymptomatic systolic and diastolic cardiac dysfunction can progress to specific heart failure due to compensatory activation of the sympathetic nervous system and renin–angiotensin–aldosterone system (RAAS).

4. Prevention of heart failure in Arterial hypertension

It has been estimated that treating hypertension can reduce the relative risk of developing CHF by about 50%. The effect of hypertension treatment on the development of CHF has been shown in isolated systolic hypertension, with the relative risk reduced by 51% in the STOP study and 55% in the SHEP study [12]. A meta-analysis of the efficacy of various antihypertensive treatments, in particular high doses of diuretics, has shown the effect of reducing the risk of developing CHF in the treatment of arterial hypertension [13]. This was confirmed by ALLHAT [14]. Comparison of different classes of antihypertensive drugs has shown that Ace inhibitors in newly emerging heart failure are no different from diuretic/beta-blocker-based regimens [15]. In general, it is sufficient that RAAS inhibitors are as effective as diuretic/beta-blocker-based therapy in reducing the rate of CHF development in patients with hypertension. In contrast to treatment with diuretics/beta blockers, RAAS inhibitors, including Ace inhibitors (ACEI) and angiotensin receptor blockers (ARBs), have the potential to prevent the development of emerging diabetes.

5. Treatment of hypertension in patients with chronic heart failure

Patients with CHF may have arterial hypertension. High blood pressure is a better survival rate in hypertensive patients compared to normotensive or antihypertensive individuals [16]. Thus, hypertension leads to an increase in post-load load in patients with CHF setting, which can lead to a significant change in shock volume. Several classes of drugs, such as Beta blockers (bb), AHP, ARBs, and aldosterone antagonists, have been shown to improve outcomes for patients with CHF.

In the treatment of arterial hypertension in patients with CHF, it is necessary to take into account the type of cardiac dysfunction: systolic or diastolic. The goal of antihypertensive therapy in systolic dysfunction is to reduce previous and subsequent loads. Preferred antihypertensive therapy includes diuretics, aldosterone antagonists, AHP, and bb, all of which have strong evidence to improve survival in CHF. AHAP is the main therapy for heart failure. In patients with mild and progressive CHF, AHP reduces the level of development of cardiac dysfunction and reduces mortality from cardiovascular disease. They are also effective in terms of lowering the level of pronounced heart failure in patients with asymptomatic left ventricular systolic dysfunction. AHAP has additional benefits in patients with arterial hypertension and HLV.

The importance of using AAF in patients with CHF and left ventricular systolic dysfunction has been evident in large randomized clinical studies in post-myocardial infarction patients. Among other ACEis, there is the most reliable evidence: captopril, enalapril, ramipril, and trandolapril [17-20]. For example, a Trace study found that treating patients with left ventricular systolic dysfunction shortly after myocardial infarction with trandolapril reduced all-cause death, cardiovascular death, risk of developing severe heart failure, risk of sudden death, and atrial fibrillation [21].

A subsequent TRACE study compared patients who received trandolapril therapy from the initial study and subjects who were prescribed trandolapril after the initial study was completed. A twelve-year follow-up study by TRACE showed that patients treated early with trandolapril had better survival rates. This result highlights the need for early treatment of AAPF in patients with left ventricular systolic dysfunction after Im to increase clinical benefits for the patient.

The effect of ACEI on mortality and morbidity is dose-dependent [22]. The dose of ACEI should be selected as tolerably as possible. The recommended initial and target doses of IAF are listed in Table 1 with evidence of reduced mortality/morbidity.

It is necessary to give preference to drugs that have a long-term effect and are dosed once a day in terms of patients ' adherence to recommendations. Arb is usually prescribed to patients with AAPF intolerance. Indications for Arb therapy are the same as AHP in patients with CHF. There is no evidence that ARB is better than ACEI. The advantage of AAPF / arb combined therapy for CHF has not been proven.

CHF approved losartan, valsartan and candesartan for treatment [23,24]. The recommended initial and target doses of ARB are listed in Table 2.

Beta Blockers Reduce sympathoadrenal activity at the beta receptor level. Based on the results of large randomized clinical studies, beta blockers are considered as standard therapy in patients with mild and progressive CHF. Bb reduces mortality from all causes and cardiovascular diseases, the risk of sudden death, the risk of hospitalization with heart failure and the risk of death due to the development of heart failure. There is the best evidence for carvedilol, metoprolol Succinate, bisoprolol and Nebivolol [25-28]. The effect of Bb on the result is also dose-dependent. The recommended initial and target doses are given in Table 3.

Table 1-doses ACEI

	Initial dose (mg)	Dose per day	Target dose	Dose per day
Captopril	18,75	3	150	3
Enalapril	2,5	2	20	2
Lisinopril	2,5	1	20–35	1
Ramipril	2,5	1	5	2
Trandolapril	0,5	1	4	1

Table 2-dosages bra

	Initial dose (mg)	Dose per day	Target dose	Dose per day
Losartan	12,5	1	50–100	2
Valsartan	40	2	160	2
Candesartan	4	1	32	1

Table 3-doses of beta blockers

	Carvedilol	Metoprolol Succinate	Bisoprolol	Nebivolol
Initial dose (mg)	3.125	12,5 ed	1,25 ed	2,5 ed
Target dose	25–50	150–200 ed	10 ed	10 ed

Table 4 – Recommended doses of diuretics for CHF

	Initial dose		Normal daily dose	
Loop diuretic				
Furosemide	20–40		40–240 (250мг)	
Thiazide diuretic				
Hydrochlorothiazide	25		12,5–100	
Indapamide	2,5		2,5–5	
Potassium-saving diuretic	Usual	In the absence of ACEI/ARB	Usual	In the absence of ACEI/ARB
Amiloride	2,5	5	5–10	10–20

Aldosterone antagonists are recommended for NYHA II–IV stable chronic heart failure in order to reduce the risk of death and hospitalization due to heart failure [29,30]. Loop and thiazide diuretics are effective in patients with fluid overload. Loop diuretics can be used in patients with acute heart failure in hypertensive crisis and severe arterial hypertension in chronic heart failure, mainly in people with impaired renal function [31]. The recommended doses of diuretics are given in Table 4.

If blood pressure remains high in patients with heart failure despite optimal heart failure therapy, vasodilators such as a combination of hydralazine and isosorbide dinitrate or dihydropyridine calcium channel blockers (CCBS) can be used [32]. The treatment of patients with hypertension, diastolic heart dysfunction and CHF is unclear. The role of inhibiting Raas is not very clear. In diastolic dysfunction, an excessive decrease in preload should be avoided, which can lead to cardiac output and a decrease in arterial hypotension. In diastolic heart failure, diuretics, venodilators and dihydropyridine CCB should be used with caution.

LVH is usually present in diastolic heart failure. LVH regression is an important therapeutic target. A relative decrease in left ventricular mass was shown after treatment with arb, CCB, and AAPF, leading to significantly more regression than beta-blockers [23]. Unlike systolic heart failure, verapamil (non-epigidropyridine CCB) can be useful in these conditions [14].

6. Conclusion

Arterial hypertension is the main cause of the development of left ventricular hypertrophy and later CHF. The optimal target blood pressure for patients with CHF has not been determined.

In patients with systolic dysfunction, the goal of therapy is the lowest blood pressure not associated with symptoms of hypotension or hypoperfusion. In patients with diastolic heart failure, blood pressure varies greatly from patient to patient, because in intensive antihypertensive regimes there is a risk of overload and an excessive decrease in subsequent load.

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