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Acute myocardial infarction with ST-segment elevation: effect of myocardial revascularization, Atorvastatin, Bisoprolol, perindopril and antiplatelet drugs on heart remodeling, systolic and diastolic dysfunction and cardiac complications over the period of 24.3 months

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Abstract

28 male patients aged 42-65 years with AMI with ST-segment elevation being treated at the infarction department of Vinnitsia city hospital No1 from 2007 to 2014 were studied. AMI with comorbid arterial hypertension occurred in 23 patients (82.1%). Troponin I contents, blood lipids, ECG, M- and B-mode echocardiography data were studied to control the effect of treatment; coronary angiography was done using Siemens Axiom Sensis XP (Germany) unit. In male patients with AMI and elevation of ST-segment before treatment there was domination in eccentric type of LVH; tendency to the development of III (severe) degree and II (moderate) degree of LV dilation; I and II degrees of left atrium dilation indicating the development of heart remodeling. Impaired systolic function was not common, and predominant type of diastolic dysfunction was delayed relaxation. After CA stenting and further treatment with atorvastatin, bisoprolol, perindopril and ASA in optimal doses over the period of 24.3 months (clopidogrel was administered only for 3 months) there was decrease of LVH types, left atrium dilation, systolic and diastolic dysfunction indicating the regression of heart remodeling which had positive effect on clinical course of disease. However, there was progressive increase in angina attacks, cardiac failure, and one case of nonfatal MI.

Keywords: acute myocardial infarction, heart remodeling, invasive and drug therapy.

1. Introduction

Ischemic heart disease (IHD) is challenge No 1 in cardiology. Among the variety of IHD forms myocardial infarction (MI) holds a special place in the USA, European and other countries. Over the last years in Ukraine the annual increase of acute myocardial infarction (AMI) is 50 thousand cases, 25 per cent of them die each year. It is known that MI often causes cardiac events (cardiac death, nonfatal MI, stroke) and other complications [1, 12]. In recent years great progress has been achieved in treatment of AMI. Patients with AMI undergo invasive therapy (coronary artery stenting, percutaneous transluminal coronary angioplasty), surgical treatment (coronary artery bypass graft) and thrombolysis [4]. Among these drug-free modalities coronary artery stenting with drug-eluting stents is the procedure of choice [4, 6, 8]. Now bioresorbable stents in AMI patients with ST-segment elevation are used as well [5].

Thrombolytic therapy is used predominantly in outpatient settings and percutaneous transluminal intervention –in specialized cardiology centers.

Patients with AMI are proved to develop left ventricular hypertrophy (LVH) which is an independent risk factor of cardio-vascular complications and early death. According to modern concept LVH is a part of heart remodeling. Remodeling of the left ventricle is considered to be the change in shape, volume and configuration of heart. Progress in LV remodeling in MI is described in literature [2, 10].

Systolic and diastolic dysfunction of the LV in MI occurs as well. However, little information is available as to the effect of coronary artery stenting combined with continuous drug therapy on heart remodeling, systolic and diastolic functions and development of complications in MI. In treatment of MI beta-blockers (BB), angiotensin-converting enzyme (ACE) inhibitors, antisclerotic preparations (statins) as well as antiplatelet drugs (acetylsalicylic acid –ASA and clopidogrel) are used.

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In many scientific works the effect of CA stenting, BB, statins and antiplatelet drugs on the clinical course of AMI in cardiology department have been studied. But there is lack of information in the literature concerning long-term follow-up data on the effect of such combined therapy in AMI on heart remodeling, systolic and diastolic dysfunction as well as primary and secondary cardiac points.

Purpose – to establish the effect of CA revascularization, antisclerotic preparation atorvastatin, BB bisoprolol, ACE inhibitor perindopril and antiplatelet drugs on heart remodeling, systolic and diastolic dysfunction as well as the development of complications in AMI with ST-segment elevation over the period of 24.3 months.

2. Materials and Methods

28 male patients aged 42-65 years with AMI and ST-segment elevation being treated at the infarction department of Vinnytsia city hospital No1 from 2007 to 2014 were studied. AMI with comorbidarterial hypertension of II-III degrees occurred in 23 patients (82.1%).

Criteria for exclusion were: age over 80, permanent atrial fibrillation, idiopathic cardiomyopathy, myocarditis, heart failure (HF) of IY functional class (FC) by NYHA classification, severe lung, liver and kidney diseases and malignancies.

Heart failure of I-III FC was present in 17 persons (60.7%) among the patients with AMI and ST-segment elevation. 10 patients (35.7%) had the history of previous myocardial infarction (MI).

Clinical blood analysis and urine tests, troponin 1, blood lipids, 12-lead ECG, M- and B-mode echo-cardiography were studied to control the effect of treatment. In addition to Genau

method used to determine LVH we suggested new criteria of diagnostics of LVH degrees, left atrium dilation and systolic dysfunction which were presented in previous publications [1]. Diastolic LV dysfunction was determined bystander method which outlines disturbances of transmitral flow.

Coronary angiography was done using Siemens Axiom Sensis XP unit (Germany).

Patients with AMI were admitted to reanimation and intensive care block of infarction department where they were given infusion therapy of intravenous analgesics (nitrates and narcotics), correction of arterial pressure, control of cardiac arrhythmias. Simultaneously they were administered antiplatelet drugs (ASA in initial dose 325 mg followed by the transition to daily maintenance dose 75 mg; clopidogrel was given in initial dose 600 mg with further transition to 75 mg/day). Such dual antiplatelet therapy was given for 3 months followed by constant administration of ASA only.

Two hours after admission coronary angiography was performed followed by CA stenting if indicated [4]. Besides antisclerotic drug atorvastatin – 20 mg/d, BB bisoprolol – 5-10 mg/d, ACE inhibitor perindopril – 5-10 mg/d were used. Such a course of treatment as well as re-examination of patients were performed in 24.3±1.44 months. The compliance to such optimal therapy was common to all patients studied.

3. Results and Discussion

28 male patients with AMI and ST-segment elevation were studied. As it had been mentioned, all patients who were admitted to reanimation and intensive care block of infarction department underwent CA stenting after receiving drug analgesic therapy with nitrates, narcotics and other preparations for two hours after establishing the diagnosis. The results of examination are given in table 1.

Table 1: Degrees of heart remodeling and systolic and diastolic dysfunction of left ventricle after CA stenting and continuous outpatient treatment with atorvastatin, bisoprolol, perindopril and antiplatelet drugs in dynamics over the period of 24.3 months.

Heart remodeling and systolic and diastolic dysfunction	Intensity of degrees and types	Before treatment n=26	After treatment n=23	P
<i>Left ventricular hypertrophy by Genau method</i>	Concentric	11 (42.3%)	8 (34.8%)	-
	Eccentric	13 (50.0%)	11 (47.8%)	-
	Total	24 (92.3%)	19 (82.6%)	-
<i>Degrees of left ventricular hypertrophy</i>	I (initial)	-	-	-
	II (moderate)	9 (34.6%)	11 (47.8%)	-
	III (severe)	17 (65.4%)	12 (52.2%)	-
	Total	26 (100.0%)	23 (100.0%)	-
<i>Degrees of dilation of left atrium</i>	I (initial)	10 (38.5%)	10 (43.5%)	-
	II (moderate)	7 (26.9%)	7 (30.4%)	-
	III (severe)	-	-	-
	Total	17 (65.4%)	17 (73.9%)	-
<i>Degrees of systolic dysfunction</i>	I (initial)	2 (7.7%)	9 (39.1%)	<0,05
	II (moderate)	2 (7.7%)	1 (4.4%)	-
	III (severe)	3 (11.5%)	-	-
	Total	7 (26.9%)	10 (43.8%)	-
<i>Types of diastolic dysfunction</i>	I (delayed relaxation)	15 (57.7%)	18 (78.3%)	-
	II (pseudonormal)	5 (19.2%)	3 (13.0%)	-
	III (restrictive)	2 (7.7%)	-	-
	Total	22 (84.6%)	21 (91.3%)	-

As it is shown in Table 1 the development of structural and functional changes of the heart were determined in patients with AMI and ST-segment elevation. Heart remodeling study by Genau method showed eccentric LVH in 13 patients (50%) and concentric LVH – in 11 patients (42.3%). Eccentric LVH is known to occur more frequently after previous MI as a result of LV dilation. The degrees of LVH in the examined patients

deserve to be studied.

Analysis of LVH degrees demonstrated that degree III (severe) occurred in 17 patients (65.4%), degree II (moderate) – in 9 patients (34.6%) and there were no patients with degree I (initial).

Determination of degrees of left atrium dilation is of great interest as well. Degree I (initial) occurred in 10 patients

(38.5%), degree II (moderate) – in 7 patients (26.9%) while no degree III was determined. Therefore, heart remodeling of various degrees of intensity developed in the patients studied as a result of structural and functional changes in the LV myocardium.

The state of systolic and diastolic function of the LV was evaluated. Systolic dysfunction of LV with decreased ejection fraction <45% was detected in 7 patients (26.9%). Diastolic dysfunction of LV occurred more frequently: type of delayed relaxation of LV – in 57.7% of patients, pseudonormal type – in 5 patients (19.2%), restrictive type – in 2 patients (7.7%).

Pathogenesis of LV diastolic dysfunction in MI is proved to be caused by the development of myocardium ischemia, arterial wall rigidity in the zone of cardiac callosity and fibrosis formation at the place of chronic ischemia with CA stenosis which is common in LVH. Restrictive type of LV diastolic dysfunction in MI is more unfavourable prognostic factor in the development of postinfarction remodeling.

Therefore, in AMI male patients with ST-segment elevation the following changes in heart remodeling were found: development of predominantly eccentric LVH, III degree of LVH and I degree of left atrium dilation. As to systolic and diastolic function of LV, the examined patients developed systolic dysfunction predominantly of I degree and diastolic dysfunction – delayed relaxation of LV. Similar results were obtained by other authors [2, 10].

Patients with AMI and ST-segment elevation after CA stenting and continuous outpatient complex treatment with ant sclerotic preparation atorvastatin, beta-blocker Bisoprolol, ACE

inhibitor enalaprilas well as antiplatelet drugs over the period of 24.3 months had predominantly positive changes of heart remodeling: decrease of concentric LVH by 7.5%, III degree (severe) of LVH – by 13.2% as a result of its transition into II degree. Dynamics of systolic and diastolic function of LV in examined patients after such treatment led to the tendency of decrease of II and III degrees of LV systolic dysfunction which resulted in significant increase of degree I diastolic dysfunction ($p<0.05$). Regression of LVH, by the results of other investigations, leads to the tendency of decrease of mortality and heart remodeling [2, 3, 11].

At the same time decrease of pseudonormal and restrictive type of LV diastolic dysfunction as a result of their transition to less prominent type of LV delayed relaxation was noted.

In this relation simvastatin was shown in the literature to cause great regression of LVH in rats with overload pressure induced by aortic ligation. Study of action of some drugs demonstrated BB to limit degrees of LV dilation along with decreased apoptosis and myocardial damage, improvement of quality of life and its longevity. ACE inhibitors induce LVH regression as well, they improve coronary and renal outflow, exhibit antihypertensive, antiarrhythmic, antisclerotic and antifibrillatory action [7]; atorvastatin has antisclerotic and pleiotropic effect. Therefore combination of CA stenting, statins, BB, ACE inhibitors and antiplatelet drugs for heart remodeling correction in AMI patients with ST-segment elevation seems reasonable and promising.

The results of study of early and late complications of this pathology are given in Table 2.

Table 2: Assessment of early and late cardiac complications in AMI patients who underwent CA stenting and continuous outpatient treatment with atorvastatin, bisoprolol, perindopril and antiplatelet drugs over the period of 24.3 months.

Cardiac complications	Early complications n=28	Late complications n=28	P
Cardiac death	-	-	-
Nonfatal MI	-	1 (3.6%)	-
Stroke	-	-	-
Readmission to the hospital	-	2 (7.1%)	-
Repeated myocardial revascularization	-	1 (3.6%)	-
Increase of angina attacks or their onset	-	4 (14.3%)	<0.05
Decrease of heart failure symptoms	-	2 (7.1%)	-
Increase of heart failure symptoms	-	10 (35.7%)	<0.01
Ventricular extrasystole of 2-5 grades	2 (7.1%)	1 (3.6%)	-
Ventricular fibrillation	-	-	-
Atrial fibrillation	4 (14.3%)	1 (3.6%)	-
AV – blocks	2 (7.1%)	-	-
His bundle block	2 (7.1%)	1 (3.6%)	-

In male patients with AMI and ST-segment elevation the following events were found before treatment: ventricular extrasystole of 2-5 grades – in 2 patients (7.1%), atrial fibrillation (AF) – in 4 (14.3%), AV blocks of II degree – in 2 (7.1%), His bundle block – in 2 (7.1%).

After complex optimal treatment in examined patients the following events were noted: development of nonfatal MI – in 1 patient, increase of angina attacks ($p<0.05$) and HF ($p<0.01$) leading to repeated myocardial revascularization in one patient because of disease progression. At the same time in these patients there was a positive tendency to decrease of atrial fibrillation (AF) by 10.7% as well as ventricular extrasystole, AV block and His bundle block.

4. Conclusions

1. In male patients with AMI and elevation of ST-segment despite the insufficient number of persons examined, there was domination by 7.7% in eccentric over concentric type

of LVH; a tendency to the development of predominantly III (severe) degree (65, 4%) and II (moderate) degree (34.6%) of LV dilation; I (initial) (38.5%) and II (moderate) degree (26.9%) of the left atrium dilation indicating the development of various degrees of heart remodeling. Impaired systolic function was not common, and delayed relaxation was predominant type of diastolic dysfunction.

2. After CA stenting and drug therapy with ant sclerotic preparation atorvastatin, BB bisoprolol, ACE inhibitor perindopril and antiplatelet drugs in optimal doses over the period of 24.3 months the following events were observed: decrease of eccentric and concentric LVH; increase of severe degree of LVH as a result of its regressive transition to moderate degree; decrease of III degree of systolic dysfunction and significant increase of I degree; decrease of III and II type of diastolic dysfunction and increase of I type of impaired diastolic function of LV

indicating the regression of heart remodeling.

3. After continuous optimal therapy there was one case of nonfatal MI, significant increase of angina attacks and HF symptoms as a result of disease progression and decrease of cases of arrhythmias and heart blocks.
4. Determination of LVH degrees, left atrial dilation, systolic dysfunction and types of diastolic dysfunction of LV in examined patients enables to see the regression of heart remodeling and systolic and diastolic dysfunction which is of definite practical and theoretical significance in cardiology.

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