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Results of percutaneous transluminal coronary angioplasty and stenting of coronary arteries in IHD patients of indigenous and non-indigenous nationality of Yakutia

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In a work basis direct and mean-term (1 year) clinical-angiographic results of percutaneous transluminal coronary angioplasty (PTCA) and stenting of coronary arteries (CA) in 86 IHD patients, residents of Yakutia are put. The factors affecting on unfavorable IHD clinical course after CA stenting, appearance of coronary stents restenosis are studied. The assessment of efficacy of application of usual metal stents and drug-eluting stents at CA stenting is given.

Keywords: coronary stenting, drug-eluting stents, restenosis in CA stents, complete anatomical and functional revascularization of myocardium.

Introduction

Last decade in our country was marked by intensive propagation of a perspective direction of small-invasive IHD treatment - percutaneous transluminal coronary angioplasty (PTCA) and stenting of coronary arteries (CA). In Yakutsk RH №1 - NCM for the first time PTCA procedure and CA stenting have been executed in 2005. Now in the department of X-ray surgery diagnostics methods and treatment annually more than 70 PTCA and CA stenting are carried out.

Implantation of coronary stents has allowed to thousands of patients with IHD to refuse a constant antiangina therapy, to dilate the vital activity and to avoid serious complications of IHD - unstable stenocardia, myocardial infarction, sudden death [7]. Despite constant perfection of technique of performance of PTCA and stenting procedures, production of new "biocompatible" stents, application of auxiliary antithrombus therapy, remains a problem of restenosis - the subsequent hemodynamically significant reduction of artery lumen in situ intervention [1]. In a result of a great number of researches risk factors of restenosis development inside stent were defined [2]. The maximum reduction of risks-factors would prevent development of this complication. The hope of the decision of this problem has occurred with producing of drug-eluting stents. [6,11,5]. However, despite overwhelming quantity of the researches confirming efficacy of application of stents with drug coating, in the last years it was revealed that development of complications in the remote period was registered significantly more often in patients with implanted "covered" stents [9, 3].

The purpose of our research was studying and assessment of clinical-angiographic results of PTCA and CA stenting in IHD patients, residents of Yakutia at application of usual metal stents and drug-eluting stents.

Materials and methods

In research 86 IHD patients, native (Yakuts) and non-native (Russians) residents of Yakutia with I FC - IV FC stenocardia (Canadian classification), «silent ischemia», microfocal and macrofocal myocardial infarction (in different terms after infarction and various localization), underwent PTCA and CA stenting, were included. Medical endovascular procedures were carried out in the department of X-ray surgery diagnostics methods and treatment on angiographic system «Axiom Artis BA» Siemens (Germany). Procedures were carried out under the standard indications: narrowing of a vessel lumen on 75 % and more, both at CA one-vascular and multivascular lesion. Direct results of intervention were estimated at

control angiography (CAG). To patients have been implanted most widely applied drug-eluting stents: Cypher, Taxus, Genous, eucaTax and without a coating: Zeta, Penta, Gazelle, Driver. In total 128 stents have been implanted in diameter from 2 mm to 3,5 mm and length from 8 to 25 mm. After stent implantation procedure in CA the qualitative and quantitative assessment of a coronary blood-flow on system TIMI 0-III was made. Criteria of successful CA stenting were cases, when: recommended degree of a residual stenosis was less than 35 % (ideally 0 %); hemodynamically significant lesion in a tract of distal outflow was absent (stenosis less than 50 %); a blood flow - not less TIMI III; dissection inside stented segment was absent (completely covered dissection); there was no defect of a lumen contrasting inside stent. As a good clinical effect of PTCA and CA stenting at presence of angiographic result in the postoperative period absence of electrocardiogram-signs of ischemia of myocardium, absence or fall of stenocardia attacks, enriching of myocardial contractility and its perfusion were considered. Out-patient aftercare of patients was carried out monthly within a year at planned visits of patients. All patients received standard treatment. After a 1-year of supervision 80 patients underwent CAG, 6 patients underwent control CAG in earlier terms in connection with negative clinical dynamics. At control CAG a state of a coronary channel as a whole and a state of CA stented segments were estimated. At presence of restenosis in stent as significant was considered narrowing of a lumen of artery ≥ 50 % from referential diameter and reduction of diameter more than on 1,2 mm. As vessel occlusion in stented segment absence of antegrade blood-flow, TIMI 0, distal than stent was considered. Statistical data processing was made with use of software package SPSS (version 17.0).

Results

From 86 patients underwent PTCA and CA stenting, 48 (55,8 %) patients were representatives of native nationality - I group and 38 (44,2 %) patients – non-native nationality of Yakutia - II group (Table 1).

Table 1. The short clinical characteristic of patients before performance of PTCA and CA stenting procedures

Indexes of the clinical status	I group (n=48)	II group (n=38)	P
Old MI with Q	17 (35,4%)	23 (60,5%)	**0,020**
Old MI without Q	19 (39,6%)	14 (36,8%)	0,795
Diabetes mellitus	6 (12,5%)	5 (13,2%)	0,928
Arterial hypertension	39 (81,3%)	34 (89,5%)	0,290
Absence of stenocardia	0 (0%)	1 (2,6%)	
Stenocardia FC - I	1 (2,1%)	1 (2,6%)	
FC - II	22 (45,8%)	11 (28,9%)	0,332
FC - III	24 (50%)	25 (65,8%)	
FC - IV	1 (2,1%)	0 (0%)	

The patients of the native and non-native nationality underwent PTCA and CA stenting, did not differ on risk factors and IHD clinical manifestations. However, frequency of penetrating myocardial infarction in the anamnesis was significantly higher in patients of non-native nationality in comparison with native patients (p=0,020).

At comparison of initial angiographic results features on frequency of diffusion of types of heart blood supply in patients of native and non-native nationality are revealed. So, in patients of the I group the right type of heart blood supply was revealed much less often, than in patients of the II group. On severity of CA lesion between patients of both groups statistically significant distinctions were not revealed (Table 2).

Table 2. Comparison of CAG results in patients of indigenous and non-indigenous nationality

Types of heart blood supply and severity of CA lesion	I group (n=48)	II group (n=38)	p
Right	7 (14,6%)	13 (34,2%)	**0,035**
Balanced	21(43,8%)	16 (42,1%)	0,879
Left	20 (41,7%)	9 (23,7%)	0,083
1 vascular CA lesion	25 (52,1%)	16 (42,1%)	0,360
2- vascular CA lesion	16 (33,3%)	17 (44,7%)	0,283
3- vascular CA lesion	7 (14,6%)	5 (13,2%)	0,850

To all 86 patients 128 stents were implanted, 109 CA stenosis were intervented. By quantity of stents in CA allocation was the following: to 53 (61,6 %) patients 1 stent in CA was installed, to 27 (31,4 %) patients - 2 stents in CA, to 3 (3,5 %) patients - 3 stents and to 3 (3,5 %) patients - 4 stents in CA. By quantity of implanted stents in CA both groups of patients had no distinctions (Table 3). In total to patients of the I group stents were implanted, to patients of the II group - 55 stents.

Table 3. Allocation of patients according to quantity of stents in CA

Quantity of stents in CA in IHD patients of both groups	I group (n=48)	II group (n=38)	P
1 stent in CA (n=53)	28 (58,3%)	25 (65,8%)	0,482
2 stents in CA (n=27)	17 (35,4%)	10 (26,3%)	0,369
3 stents in CA (n=3)	1 (2,1%)	2 (5,3%)	0,427
4 stents in CA (n=3)	2 (4,2%)	1 (2,6%)	0,701

From total number of patients underwent PTCA and CA stenting (n=86) - to 32 (37,2 %) patients stents without a medicinal coating are implanted, to 42 (48,8 %) patients – drug-eluting stents, to 12 (14 %) patients stents with a coating and without a coating have been implanted. By types of implanted stents both groups of patients also did not differ (p=0,306).

Most often stenosis in anterior interventricular artery were exposed to stenting: 32 (29,4 %) in IHD patients ИБС of native nationality and 25 (22,9 %) in IHD patients of non-native nationality. Less often stents were implanted at stenosis in RCA: 15 (13,8 %) in patients of native nationality and 12 (11 %) in patients of non-native nationality. The least quantity of the stenosis which were exposed to treatment, was in circumflex artery: 14 (12,8 %) and 11 (12 %) in native and non-native patients accordingly.

At comparison of CA stenosis types in patients of the I and II groups, underwent PTCA and stenting according to ACC/AHA morphological classification of significant distinctions are not revealed (Table 4). About in half of cases both in the indigenous and non-indigenous residents of Yakutia PTCA and CA stenting were carried out on stenosis of type A, that is on stenosis of low risk.

Table 4. Comparison of types of CA stenosis in the indigenous and non-indigenous patients in conformity with ACC/AHA morphological classification

Types of CA stenosis, underwent stenting	Stenosis in IHD patients of the I group	Stenosis in IHD patients of the II group	P
Type A	29 (47,6%)	22 (45,8%)	0,814
Type B	20 (32,8%)	15 (31,3%)	0,838
Type C	3 (4,9%)	2 (4,2%)	0,846
Types A and B	6 (9,8%)	3 (6,3%)	0,490
Types B and C	2 (3,3%)	5 (10,4%)	0,133
Types A and C	1 (1,6%)	1 (2,1%)	0,867

Direct clinical-angiographic results of stenting procedure

Optimum angiographic result (TIMI III) has been reached in 81 (94,2 %) patients. At the other 5 (5,8 %) patients on angiograms antegrade blood flow with filling of postdilate segments was defined, however balloting of contrast medium and indistinct filling with contrast medium of CA distal segments were marked. The angiographic result in these patients has been regarded on system TIMI 0-III as TIMI II. Procedure complications (dissections, occlusions of lateral branches, CA perforations, and no-reflow effect) were not marked.

Complete anatomical revascularization (of all stenosis more than 50 %) and complete functional revascularization (dilation of symptom-bound artery) have been reached in 63 (73,3 %) patients, incomplete functional revascularization (impossibility of dilation of one or several stenosis, which can invoke a myocardium ischemia) - in 23 (26,7 %) patients. At complete revascularization in 50,8 % of cases drug-eluting stents have been used, in 34,9 % of cases – stents without drug coating and in 14,3 % of cases - those and other types of stents. At a hospital stage in all cases efficacy of a myocardium revascularization by clinical criteria (Table 5) was marked. However, in 3 (3,5 %) patients were complications of arterial access in the form of the hematomas which are not demanding operative treatment, but extending patients stay in a hospital.

Table 5. A clinical state of patients after PTCA procedure and CA stenting at a hospital stage

Index	Stents with coating (42 patients)	Stents without coating (32 patients)	Stents with coating and without coating (12 patients)
Smooth clinical flow	40 (95,2%)	31(96,9%)	12 (100%)
Repeated procedures	0	0	0
AMI c Q	0	0	0
Complications of arter. access	2 (4,76%)	1 (3,13%)	0
Lethal outcome	0	0	0

Clinical-angiographic results of CA stenting at control inspection in a year after procedure performance

By results of control CAG restenosis in stented segment are revealed in 14 (16,3 %) patients, in 72 (83,7 %) patients there was no restenosis. From 14 patients with restenosis in stents repeated revascularization of myocardium (PTCA and CABG) was required to 10 (71,4 %) patients, to 4 (28,6 %) patients in connection with small degree of stenosis (30 % - 35 %) conservative treatment was made. IHD relapse in the form of unstable stenocardia and acute coronary syndrome have been registered in 3 (23,1 %) patients with restenosis in CA stents. In one case the patient after discharge from a hospital died - sudden death (Table 6). Autopsy was not made.

Table 6. A clinical state of patients after PTCA and CA stenting at control (at an out-patient stage of supervision)

Index	Stents with coating (42 patients)	Stents without coating (32 patients)	Stents with coating and without coating (12 patients)
The favorable flow	39 (92,86%)	26 (81,25%)	11 (91,67%)
Stent restenosis	4 (9,5%)	8 (25%)	2 (16,7%)
Repeated procedures	1 (2,38%)	4 (12,5%)	1 (8,33%)
AMI with Q/ without Q	0	0	0
CABG, MCBG	2 (4,8%)	2 (6,25%)	0
Lethal outcome	0	0	1 (8,33%)

In the patients having drug-eluting stents, in 1 case in a year there was a need in carrying out TBCA, in 2 cases - surgical revascularization of myocardium in connection with the big degree of restenosis in CA stents and progressing of IHD clinical symptomatics was required. In patients with implanted stents without drug coating, in 4 cases PTCA has been made (on the average in 5,75 months after stenting). In 2 cases - surgical revascularization of myocardium (in 5 and 8 months after stenting), in connection with a stent thrombosis and with stent restenosis of the big degree, with progressing of IHD clinical flow. At the analysis of the restenosis causes in 8 patients having stents without coating, it was revealed that in 6 of them steel template stents Gazelle firm «Biosensors International» (Netherlands) were implanted. In patients with implanted stents without drug coating the tendency to increasing of restenosis cases in stents in comparison with the patients having stents with antiproliferative coating (p=0,077) was marked.

Restenosis and the factors affecting on its occurrence

Among IHD indigenous patients (n=48) restenosis in CA stents is revealed in 8 (16,7 %) patients, among IHD non-indigenous patients (n=38) restenosis is revealed in 6 (15,8 %) patients, comparisons have not revealed significant distinctions (p=0,65). At comparison of IHD risk factors: arterial hypertension, diabetes, smoking, hyperlipidemia, the burdened heredity before PTCA procedure and stenting in patients with restenosis in CA stents and in patients without lumen change of stents significant distinctions are not revealed. However, in all patients with restenosis in stents, IHD was combined with arterial hypertension. The patients having restenosis in CA stents and without restenosis differed on clinical manifestations of myocardium ischemia - stenocardia. So, in patients with restenosis in CA stents angina of effort with I FC to III FC was registered, in patients without restenosis angina of effort III FC was registered less

often, than in patients with restenosis in CA stents (p=0,004). IHD relapse in the form of unstable stenocardia and acute coronary syndrome have been registered in 3 (23,1 %) patients with restenosis in CA stents and in 7 (9,6 %) patients without restenosis (p=0,16). The acute Q-forming myocardium infarction in patients with restenosis in CA stents has not been registered.

Average duration of IHD before procedure of myocardium revascularization in patients with restenosis in CA stents made 4,68±3,93 yrs and did not differ from duration of IHD in patients without restenosis - 4,16±3,88 yrs (p=0,649).

Comparison of clinical-anamnestic data and IHD risk factors in patients of various ethnic groups having restenosis in CA stents had shown that in the non-indigenous patients penetrating myocardial infarction in the anamnesis was met more often, than in the indigenous patients (p=0,005). Statistically significant distinctions between the indigenous and non-indigenous patients on risk factors and IHD clinical manifestations in groups of patients with restenosis and without restenosis in CA stents was not revealed. Thus, it is possible to assume that in patients of non-indigenous nationality presence in the anamnesis of penetrating myocardial infarction can be the unfavorable factor of restenosis development in CA stents.

At comparison of clinical manifestations of myocardium ischemia in the form of angina of effort in the patients having restenosis in CA stents and without restenosis, statistically significant distinctions have been found. So, in all patients with restenosis in CA stents angina of effort with I FC to III ФК has been registered, and stenocardia of III FC in patients with restenosis in CA stents was found significantly more often, than in patients without restenosis in CA stents (p=0,008).

Comparison of angiographic and clinical results of CA stenting in patients with restenosis and without CA restenosis, has shown that at achievement of complete anatomical and functional myocardium revascularization restenosis in CA stents was revealed considerably rarely, than at incomplete myocardium revascularization (p=0,001).

Table 7. The relative analysis of CA stenting results in indigenous and non-indigenous patients

Anatomical and functional myocardium revascularization	Patients with restenosis in CA stents (n=14)		Patients without restenosis in CA stents (n=72)		p 1-3	p 2-4
	native (n=8)	Non-native (n=6)	native (n=40)	Non-native (n=32)		
	1	2	3	4		
Complete revascularization (n=63)	4 (50%)	1 (16,7%)	32 (80%)	26 (81,3%)	**0,074**	**0,001**
Incomplete revascularization (n=23)	4 (50%)	5 (83,3%)	8 (20%)	6 (18,8%)		

In group of the indigenous patients the tendency to augmentation of restenosis cases in CA stents is found at incomplete myocardium revascularization (Table 7). In the non-indigenous patients the interrelation of incomplete anatomical and functional myocardium revascularization with development of restenosis in CA stents (p=0,001) is revealed.

By comparison of types of heart blood supply in indigenous and non-indigenous patients with restenosis the tendency of prevalence in the indigenous of balanced type of heart blood supply, and in the non-indigenous - the right type (p=0,061) is revealed. Comparisons in group of patients without CA restenosis have shown the following: in the indigenous patients with IHD the left type, in the non-indigenous - the balanced type of heart blood supply (p=0,028) prevailed. Comparisons in ethnic groups of patients with restenosis and without restenosis of CA stents have revealed that in group of indigenous patients with restenosis of CA stents there was no left type of heart blood circulation in comparison with indigenous patients not having restenosis in CA stents. Thus, it is possible to conclude that in our research the favorable course after implantation of stents in CA (restenosis absence) in indigenous patients associated with presence of the left type of heart blood supply. Comparison of CAG results in groups of indigenous and non-indigenous patients with restenosis and without restenosis of CA stents has not revealed interrelation of restenosis process of coronary stents with quantity of implanted stents.

At studying of restenosis process in coronary stents in patients with various severity of lesion and localization of critical stenosis in CA significant distinctions in groups of native and non-native patients with restenosis in CA stents are revealed. So, among patients of non-native nationality with restenosis in coronary stents patients with widespread lesion of RCA in comparison with patients of native nationality (Table 8) prevailed.

Table 8. Atherosclerotic lesion of RCA in patients with restenosis and without restenosis in coronary stents

Index of severityt of RCA lesion	Patients with restenosis in CA stents		Patients without restenosis in CA stents		P			
	I (n=8)	N (n=6)	I (n=40)	N (n=32)	1-2	3-4	1-3	2-4
	1	**2**	**3**	**4**				
Insignificant stenosis in RCA	6 (75%)	1 (16,7%)	19 (47,5%)	16 (50%)	**0,031**	0,833	0,162	0,140
Critical stenosis and occlusion of RCA	2 (25%)	5 (83,8%)	21 (52,5%)	16 (50%)				

All patients with restenosis of coronary stents had critical stenosis in AIVA, but statistically significant distinctions between groups of patients of indigenous and non-indigenous nationality is not revealed.

Comparison of morphological types of CA stenosis in patients with restenosis and without restenosis has revealed that in patients with CA stents' restenosis initially more often were exposed PTCA and stenting of stenosis of middle and high risk and, on the contrary, in

patients without restenosis more often PTCA and stenting of low risk stenosis were carried out (Table 9).

Table 9. The relative analysis of morphological characteristics of CA stenosis КА in patients with revealed stents' restenosis and without restenosis of CA stents

Types of stented CA stenosis	Patients with restenosis in stents (n=14)	Patients without restenosis in stents (n=72)	p
Type A	0 (0%)	44 (61,1%)	-
Type B	9 (64,3%)	20 (27,8%)	**0,010**
Type C	4 (28,6%)	1 (1,4%)	**0,0001**
Types A and B	0 (0%)	4 (5,6%)	-
Types B and C	1 (7,1%)	2 (2,8%)	0,418
Types A and C	0 (0%)	1 (1,4%)	-

Between patients of indigenous and non-indigenous nationality significant distinctions between initial morphological type of CA stenosis with restenosis process in CA stents are not revealed.

Discussion. In our research patients of indigenous and non-indigenous nationality of Yakutia underwent procedure of PTCA and CA stenting did not differ on IHD risk factors, localization, prevalence and severity of atherosclerotic lesion of coronary arteries. However, the old penetrating myocardial infarction in the anamnesis in group of non-indigenous patients was met authentically more often, than in the indigenous. At comparison of type of heart blood supply authentic distinctions also were found: in patients of indigenous nationality the right type of heart blood supply was revealed authentically infrequently, than in non-indigenous patients (p=0,035). By quantity, localization and kinds of implanted stents in CA both groups of patients of indigenous and non-indigenous nationality did not differ. PTCA and implantation of stents in CA in both groups of patients was carried out on stenosis of low risk that probably explained optimal angiographic result directly after procedure and the favorable clinical course of IHD at a hospital stage. At control, in 14 (16,3 %) patients restenosis in CA stented segments have been revealed, and to 6 patients control angiography was made in earlier terms in connection with stenocardia progressing. The index of revealed restenosis in patients coordinates with the data of some authors. The lethality at the out-patient stage after PTCA and CA stenting has made 8,3 %.

The relative assessment of application of usual stents and drug-eluting stents in our research has not revealed authentic distinctions in frequency of restenosis development both in the general group of patients, and in IHD patients of indigenous and non-indigenous nationality of Yakutia. However, in patients with implanted stents without drug coating the tendency to increase of restenosis cases in stents in comparison with the patients having stents with antiproliferative coating (p=0,077) was marked.

Restenosis in CA stents happened more often at stenting of stenosis of moderate and high risk (type B and type C), at incomplete anatomical and functional myocardium revascularization.

All patients of non-indigenous nationality with restenosis in CA stents had penetrating myocardial infarction in the anamnesis. In them more often, than in the indigenous the right type of heart blood supply and heavier atherosclerotic lesion of RCA prevailed. All patients of non-indigenous nationality with restenosis of coronary stents had critical stenosis and occlusions of AIVA. This data coordinate with numerous researches of restenosis process of CA stents in which myocardial infarction in the anamnesis and AIVA lesion have been defined as the main risks-factors of restenosis development in stent [4, 10]. Results of angiographic inspection of

indigenous patients with restenosis in stents differed from results of non-indigenous patients. So, in them the balanced type of heart blood supply is more often revealed and there was no left type, they had more often insignificant stenosis in RCA and rarely, than non-indigenous – myocardial infarction in the anamnesis. However, in 100 % of cases in indigenous patients with restenosis of coronary stents, also as well as non-indigenous, severe lesion of AIVA has been revealed. In view of that is the most frequent both in group of indigenous, and in group of non-indigenous IHD patients, of stents were implanted into AIVA, in indigenous patients at the left type of blood supply disorder of a coronary alimentation in AIVA basin at restenosis in stent would lead to more serious coronary events, than in non-indigenous patients. Considering that in our research of group of indigenous and non-indigenous patients did not differ by quantity of stented stenosis in AIVA and on number of patients with restenosis in stents, it is possible to assume that the revealed features are caused by initial distinctions of angiographic pattern - prevalence in group of indigenous patients with restenosis of coronary stents insignificant stenosis of RCA and achievement in group of indigenous patients of complete myocardium revascularization in 50 % of cases, and in group of non-indigenous patients only in 16,7 % of cases. In result, in our research positive angiographic result and the favorable clinical course after implantation of coronary stents (restenosis absence) was observed in indigenous patients with the left type of heart blood supply. In whole, the obtained data has shown the following:

1) direct optimum angiographic result of PTCA and CA stenting has been reached in 81 (94,2 %) patient. At control inspection in 72 (83,7 %) patients efficacy of myocardium revascularization after PTCA and CA stenting on clinical and angiographic criteria was marked.

2) we did not reveal statistically authentic distinctions in occurrence of restenosis after implantation in CA of drug-eluting stents and stents without drug coating, however, a tendency (p=0,077) to increasing of cases of restenosis in CA stents in patients with stents without antiproliferative coating was marked.

3) achievement of complete myocardium revascularization at stenting, PTCA and stenting of low risk stenosis (type A) reduces risk of occurrence of restenosis in stented CA segments and raises efficacy of treatment of IHD patients.

In our research by angiographic data in patients of non-indigenous nationality with restenosis in CA stents the right type of heart blood supply, and heavier RCA atherosclerotic lesion prevailed. Indigenous patients with restenosis of CA stents more often had a balanced type of heart blood supply, there was no left type and more often insignificant stenosis in RCA was revealed.

In the conclusion it is necessary to note that the revealed distinctions in angiographic pattern in patients with restenosis of coronary stents of indigenous and non-indigenous nationality, possibly, are caused by genetical features of morphoanatomical pattern of coronary heart blood supply. The revealed facts demand the further profound studying.

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The indices of heart rate turbulence In indigenous and non-indigenous residents of Yakutia

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The aim of the research is to investigate the indices of heart rate turbulence among indigenous and non- indigenous residents of Yakutia.

The patients with different diagnoses who were directed to the Holter ECG monitoring at the department of functional diagnosis by the doctors of cardiology clinical advisory department of RH № 1-NCM were examined.

The pathological values of HRT were registered more often among non-indigenous residents of Yakutia, in the older age group and patients with a strong family history.