

Comparative Efficiency of Surgical and Intra-Coronary Revascularization in Patients with Instable Angina against the Background of Diabetes Mellitus

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Abstract **Goal of investigation:** to define long-term angiographic and hemodynamic efficiency of different methods of revascularization in patients with instable angina against the background of diabetes mellitus (DM). **Material and methods:** 82 diabetic patients with instable angina were included to investigation. 40 of them (group of coronary artery bypass grafting (CABG)) were undergone surgical revascularization (during 1 month after CHD destabilization episode), the rest of 42 patients (group of transcatheter coronary intervention (TCI)) – were performed stenting of coronary arteries (immediately after angiography). Initially and 12 months after revascularization all patients were performed echocardiographic investigation (EchoCG) and control coronarography. **Conclusion:** Investigation has proved that surgical revascularization of the patients with DM provides fuller coronary perfusion by the 12th month of observation in compare with TCI. It promotes the reduction of left atrium (LA) size which is one of the indices of LA full pumping function. In the TCI group LA size has been decreased. It testifies the keeping and progressing of myocardial failure. At the same time both methods of revascularization have promoted comparable improvements of the left ventricle (LV) end diastolic volume (EDV) and ejection fraction of LV (EF LV) indices.

Keywords Unstable angina, Diabetes mellitus, Coronary artery by-pass grafting, Coronary arteries stenting

Current level of medicine provides revascularization as treatment standard of coronary heart disease (CHD). In the case of instable angina (IA) in consideration of atherosclerotic plaque instability which is the base of pathogenesis, revascularization is a key point of the therapy. There are continuous debates in the literature about which revascularization method is more preferable at IA, especially at the presence of background disease such as diabetes mellitus (DM) which activates pro-inflammatory reactions. As some investigations showed, the frequency of end points in patients with DM were significantly higher than in patients without metabolic disorders even after revascularization [1]. At the same time, in patients with DM surgical revascularization had more positive effect on 10-year survival rate in compare with coronary angioplasty. Patients with monovascular lesion (identical results independently from revascularization method) or patients with a high operation risk (significantly better results after angioplasty) made up an exception [2].

Object of the research is to define long-term angiographic and hemodynamic efficiency of different revascularization methods in patients with instable angina against the background of diabetes mellitus (DM).

1. Material and Methods

82 patients with instable angina which has been developed against the background of DM were included to the investigation. Only those patients who were undergone diagnostic coronarography and who had indications for revascularization were included to investigation. 40 of them (CABG group) were performed surgical revascularization (during one month after CHD destabilization episode) and the rest of 42 patients (group of transcatheter coronary intervention (TCI)) – were performed stenting of coronary arteries (immediately after angiography).

The mean age of patients made up 58,84±3,28 years. All patients were performed echoangiographic investigation (EchoCG) and control coronarography primary and 12 months after revascularization. EchoCG determined the sizes of heart left cavity, an indexed mass of left ventricle myocardium to the area of body surface, parameters of left

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ventricle myocardium global systolic function (ejection fraction - LV EF). TIMI coronary blood flow scheme has been used for the estimation of angiography results (figure 1).

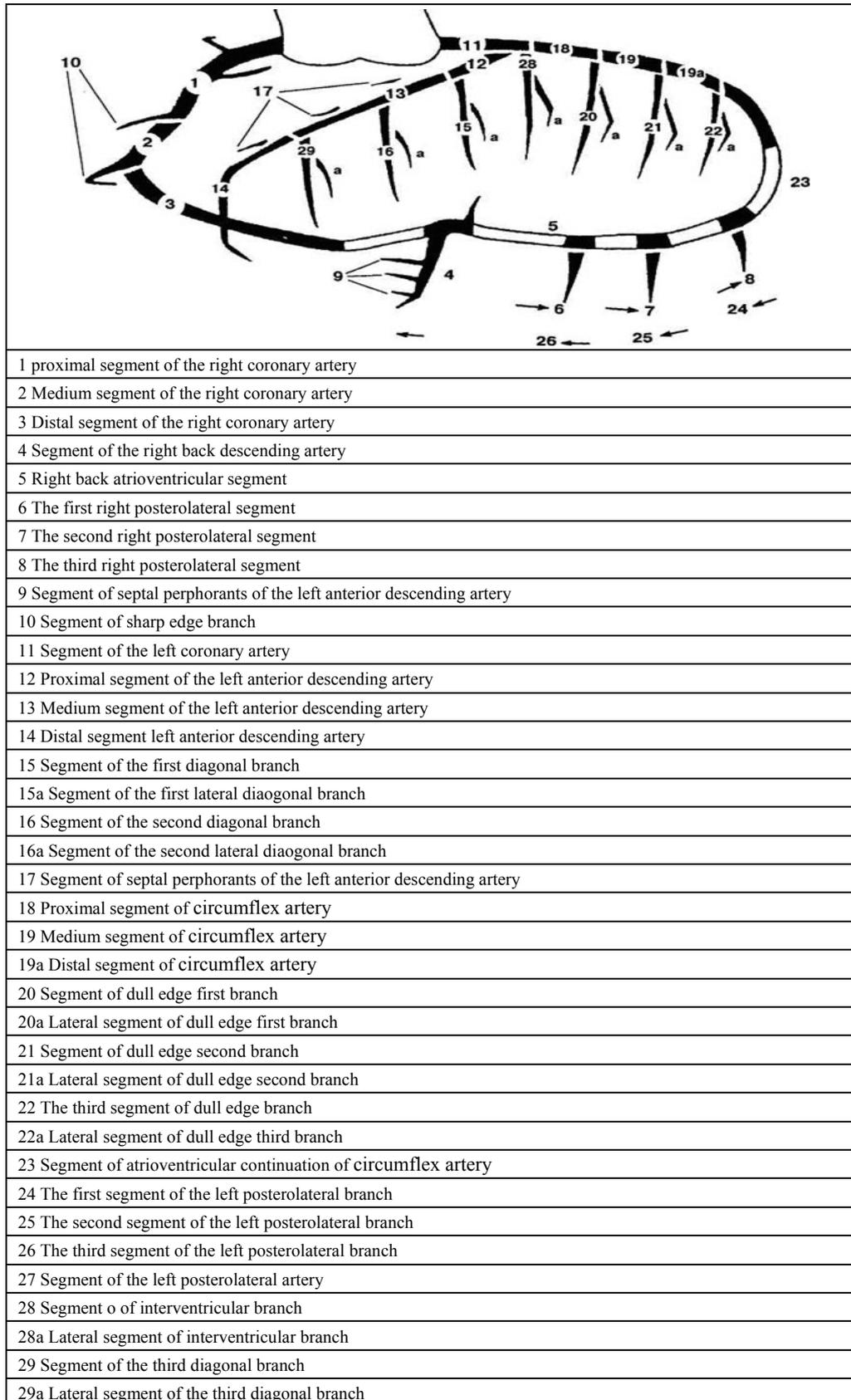


Figure 1. Scheme of TIMI coronary blood flow

Table 1. Localization of coronary artery stenosis in patients with CHD against the background of DM subject to the requirement in revascularization

	CABG (n=40)		TCI (n=42)		Significance of difference	
	% stenosis	frequency	%stenosis	frequency	% stenosis	Frequency (χ^2)
1. Proximal segment of the right coronary artery	90,6±11,06	25(62,5%)	90±0	10(23,81%)	ns	11,01***
2. Medium segment of the right coronary artery	78,33±14,84	15(37,5%)	75,32±13,03	31(73,81%)	ns	9,54**
3. Distal segment of the right coronary artery	75±15,81	10(25%)		0		
11. Segment of the left coronary artery	71,67±16,00	15(37,5%)		0		
12. Proximal segment of the left anterior descending artery	95±4,70	35(87,5%)	65±0	5(11,90%)	P<0,001	43,88***
13. Medium segment of the left anterior descending artery	80±10,54	10(25%)	73,33±13,54	21(50%)	ns	4,43*
14. Distal segment of the left anterior descending artery	93,33±4,88	15(37,5%)	50±0	5(11,90%)	P<0,001	5,96*
15. Segment of the first diagonal branch	90±0	5(12,5%)	80±0	5(11,90%)		0,07
18. Proximal segment of circumflex artery	83,33±17,59	15(37,5%)	90±0	6(14,29%)	ns	4,64*
19. Medium segment of circumflex artery	50±0	5(12,5%)		0	ns	
19a. Distal segment of circumflex artery		0	65,45±5,22	11(26,19%)	ns	
20. Segment of the first branch of dull edge	80±10,54	10(25%)		0	ns	

Note: significance of χ^2 criterion is 2x2: * - p<0,05, ** - p<0,01, *** - p<0,001.

Statistical analysis included the calculation of median arithmetical rate, their standard deviates, estimation of significant differences of intergroup mean rates with the use of the Student's binate and odd criterion. Relative dynamics of investigated indices in the groups was determined as follows: indices of relative dynamics in each patient in the group was calculated with further determination of average arithmetic quantity. Difference of frequency occurrence signs in groups were estimated with the use of χ^2 criterion. The Paerson's correlation coefficient with its significance estimation to the Student's criterion has been used for correlation analysis.

2. Results and Discussion

Primary performed diagnostic coronarangiography revealed more hemodynamically significant stenosis in patients who required surgical revascularization in compare with those ones who were undergone coronary arteries stenting (4,00±1,31 vs 2,24±1,19 stenosis, p<0,001). The following differences by anatomic character of coronary by-pass lesion were registered (as it is presented in table 1): patients with left coronary artery trunk involvement were not included to TCI group (37,5% of such patients were in CABG group), the lesions of right coronary artery distal segment were not also registered in that group (25% in CABG group), involvement of circumflex artery medium segment (there were 12,5% cases in CABG group) and dull edge first branch segment (25% cases of CABG group), and there was not an involvement of circumflex artery distal segment in CABG group (26,19% patients of TCI group). Stenting was more frequently performed on the right coronary artery medium segment (73,81% vs 37,5%, p<0,01)

and on the medium segment of anterior interventricular artery (50% vs 25%, p<0,05).

The following lesions more frequent occurred in CABG group: lesion of the right coronary artery proximal segments (62,5% vs 23,81%, p<0,001), anterior interventricular artery (87,5% vs 11,90%, p<0,001), circumflex artery (37,5% vs 14,29%, p<0,05) and distal segment of anterior interventricular artery (37,5% vs 11,90%, p<0,05). At the same time, in TCI group average level of proximal and distal segment of anterior descending artery stenosis was significantly lower than in CABG group (p<0,001 for proximal and p<0,05 for distal segment). So, these lesions were not the basic argument for the choice of revascularization method. The rest of stenotic lesions localization by the evidence level of stenosis were comparable. The involvement of the first diagonal branch equally occurred in both clinical groups.

1,74±0,065 stents have been implanted in TCI group on average, 3,25±0,98 coronary bypasses were performed in CABG group on average .

Primary performed EchCG investigation to all patients has revealed that LA dilatation was significantly bigger in CABG group patients in compare with TCI group patients (p<0,001, table 2). LV size was not-significantly bigger and systolic function was not-significantly lower in patients of surgical revascularization group in compare with TCI group.

The control investigation which was carried out in 12 months after revascularization revealed the following regularity: In TCI group, in spite of conducted revascularization, significant progressive increase of anterior-back diameter of LA has been registered (15,59%, p<0,001), but at the same time, the surgical revascularization is associated with some not-significant decrease of this

parameter (-1,72%, significance of comparative dynamics difference between groups $p < 0,001$). LV parameters showed a significant decrease of EDV (8,44% in TCI group, $p < 0,05$ with primary data and 6,43% in CABG group, $p < 0,05$) and decrease of EF (to 10,19% in TCI group and 15,81%, $p < 0,001$ in CABG group). Comparative dynamics of both rates was comparable in both groups.

Table 2. Dynamics of LA, EDD and LV sizes and LV EF during a year after revascularization in patients with instable angina and diabetes mellitus subject to revascularization method

	TCI	%	CABG	%
LA (cm)	3,27±0,39 3,77±0,34***	15,59	4,03±0,44^^ 3,95±0,37^	-1,72^^
EDV (by Simpson's method)	147,55±36,35 131,90±24,23*	-8,44	149,43±37,28 136,00±29,58	-6,43
EF%	48,92±10,67 53,17±8,55	10,19	47,50±5,41 54,25±4,38***	15,81

Note: significance of difference with primary data inside the groups *CABG and TCI - ^: One sign - $p < 0,05$, two signs - $p < 0,01$, three signs - $p < 0,001$.

Control coronarangiography which was performed in 12 months after revascularization detected that bypasses worked well in all cases providing adequate coronary blood flow in CABG group, but in 37(88,10%) patients of TCI group there were discovered hemodynamically significant stenosis (3,67±2,04 stenosis on average), including re-stenosis of implanted stents in 15 (35,71%) patients.

LA is a chamber-reservoir correcting pump function of the heart. So, at decrease of myocardium systolic function displacement of ejection volume and LV EDV correlation to decrease of EDV is noted. It leads to decrease of the end diastolic pressure to LV cavity and it complicates an achieving of the pressure's diastolic gradient on mitral valve, disturbs the process of early diastolic filling, promotes the decrease of LV cavity. Improvement of myocardium systolic function increases an impact of systole and decreases the level of end diastolic pressure, promotes the process of early diastole and decreases LA volume's overload. EDV is decreased against the background of revascularization and LV EF is increased (as our investigation showed,

comparably, independently from revascularization method). But LA size dynamics reflects latent contractile failure of LV myocardium [3, 4]. Our research discovered the increase of LA size in patients with DM after TCI which was probably the EchCG manifestation of coronary blood flow leaking after TCI. Correlated analysis detected positive average bond between stenosis quantity and relative, but not absolute percent dynamics of LA size ($r = +47$, $p < 0,05$) in TCI group. The same results have been discovered in the investigation of Russo C. *et al*, 2012 [3].

Thereby, the research proved that surgical revascularization in patients with DM provides better coronary blood flow than TCI by the 12th month of observation. It promotes a significant decrease of LA size which is one of LV pump function's adequacy index. LA size was decreased in TCI group and it testified about keeping and progressing of myocardial failure. But at the same time, both revascularization methods promoted a significant comparable improvement of LV end diastolic volume and ejection fraction of LV.

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