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## ANALYSIS OF MYOCARDIAL CONTRACTILITY DYNAMICS IN PATIENTS WITH MYOCARDIAL INFARCTION

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*Abstract.Objective:* to study the dynamics of myocardial contractility and diastolic dysfunction in the groups of patients with different tactics of coronary blood flow restoration.

*Key words:* acute myocardial infarction, thrombolysis, coronarography, PCI, myocardial contractility.

**Materials and Methods:** the study enrolled 45 male patients with ST-segment elevation ACS who applied to the hospital in the first 6 hours after the anginal attack. The patients were divided into 3 groups depending on the chosen tactics. Group I - 13 patients who underwent thrombolytic therapy, Group II - 15 patients who underwent CAG and PCI within 12 hours of pain onset, Group III - 17 patients who underwent delayed PCI. All patients underwent EchoCS in M- and B-mode on the 1st day after blood flow recovery and 2 weeks later.

**Results:** The study of the blood flow restoration according to ISA showed its more significant improvement in the group of patients, who underwent emergency angioplasty with stenting and TIMI was 2.7 and 2.3 respectively in the groups II and III. The analysis of ST-segment dynamics in the studied groups also revealed more pronounced regression in the group of patients with PCI - 85%, then 78% in the group of patients with delayed PCI and 69% in the group of patients who underwent only TLT. In the group of patients who underwent TLT there was a significant increase of cardiac output from 115.8 to 132 ml, and in the group of patients, in which angioplasty and stenting were performed within the first 6 hours after pain syndrome onset, cardiac output increased slightly from 117.2 to 120.8 ml, and in the group of patients with delayed PCI from 115.4 to 126.1 ml. The CVD also underwent changes by the end of 14 days of MI. The analysis of EF dynamics also revealed similar dynamics, where the most significant decrease was observed in the TLT group. Thus, on the 14th day there was a decrease in EF from 54.8% to 46%, while in the other groups the dynamics of this index did not reach statistical significance.

**Conclusions:** this study showed the advantage of primary angioplasty over delayed PCI in MI in terms of improvement of myocardial contractile function, reduction of necrosis area. But nevertheless, delayed PCI demonstrated advantage over thrombolytic therapy with regard to the development of diastolic myocardial dysfunction, which will undoubtedly affect the improvement of life prognosis in these patients in future.

Myocardial infarction (MI) is still the leading cause of cardiovascular mortality. And the important task of cardiologists to save patients' lives and improve their prognosis of life is timely restoration of coronary blood flow in the lesion area [1]. Currently, there are two main methods to restore blood flow in the coronary arteries - thrombolytic therapy performed up to 6 hours from the onset of pain syndrome and mechanical restoration - angioplasty and stenting of infarct-related artery (IVA) within 12 hours from the onset of pain attack [2]. Nevertheless, it should be noted that there is a problem of patients' timely application to hospitals, as well as the availability of catheterization laboratories. Often patients apply later than the specified dates, which does not allow them to fully provide the necessary medical care, which would prevent the development of various

complications (heart failure, fatal arrhythmias, repeated infarcts) in the future. The issue of delayed percutaneous interventions (PCI) in patients is widely discussed in the literature. Some authors argue about the uselessness of this method beyond 12 hours, while others insist that PCI ISA is a necessary tactic even if the patient is delivered to the hospital after the specified terms [3].

Therefore, we were interested to study the peculiarities of myocardial contractility and diastolic dysfunction dynamics in the groups of patients with different tactics of coronary blood flow restoration.

**Materials and Methods:**

The study involved 45 male patients with ST-segment elevation ACS who applied to the Urgench Branch of RCC and RSCEPM in the first 6 hours from the anginal attack. The exclusion criteria were age over 65 years, female sex, PICS, acute cerebral circulation disorder, cardiogenic shock, severe renal and hepatic insufficiency, permanent form of atrial fibrillation. The patients were divided into 3 groups depending on the chosen tactics. Group I - 13 patients who underwent thrombolytic therapy, Group II - 15 patients who underwent CAG and PCI within 12 hours of pain onset, Group III - 17 patients who underwent delayed PCI.

**Tab 1. Clinical characteristics of the compared groups**

| Indicators | I – 13 pts | II – 15 pts | III – 17 pts |
|------------|------------|-------------|--------------|
| Age        | 48,3±9,6   | 46,5±6,3    | 46,0±7,7     |
| AH         | 9 (69%)    | 12 (80%)    | 11 (67,4%)   |
| DM         | 5 (38,5%)  | 5 (30%)     | 7 (41,2%)    |
| BMI        | 27,3±2,9   | 26,5±3,1    | 26,2±3,5     |
| AHF        |            |             |              |
| I          | 5 (38,5%)  | 3 (20%)     | 6 (35,3%)    |
| II         | 2 (15,4%)  | 3 (20%)     | 3 (17,6%)    |

The compared groups were comparable by the main clinical characteristics. Selective coronary angiography (CAG) of the coronary vessels was performed to assess the X-ray morphological characteristics of the patients taking into account angiographic parameters: stenosis percentage, number of stenotic lesions, ACC/AHA classification of stenotic lesions, lesion localization (proximal, middle, distal) and arterial diameter. Group II and III patients underwent stenting of the infarct-related artery.

All patients, regardless of the applied tactics, received therapy with beta-blockers, angiotensin-converting enzyme inhibitors, statins, antiaggregants in comparable doses.

To assess myocardial contractility, all patients underwent echocardiography on ..... in M- and B-mode on the first day after coronary blood flow restoration, as well as 2 weeks later according to the standard technique using the recommendations of American Echocardiographic Society. The following indices were measured and calculated: interventricular septal thickness (IVS); LV posterior wall thickness (LV PWS); LV end-diastolic dimension (EDD), LV end-systolic dimension (ESD), LV ejection fraction (LVEF). To assess LV diastolic function we studied Doppler echocardiographic indices of transmitral blood flow: flow velocity in early diastole phase (E) and flow velocity in left atrial systole phase (A), their ratio (E/A), time of early diastolic filling flow slowing (DT), isovolumetric LV relaxation time (IVRT) [4].

Statistical processing of the obtained results was performed on a Pentium-IV personal computer using the "Statistica 6.0" software package.

**Results of the study:**

The study of CAG results (CAG was not performed in the TLT group) in the compared groups showed a comparable number of affected arteries in the groups - 1.5 and 1.7, respectively, in groups II and III. The coronary index was 8.9 and 9.3, respectively. Two-vessel lesion was detected in 7 and 9 cases in Groups II and III, single-vessel lesion was detected in 8 cases in each group. The study of blood flow recovery by ISA showed its more pronounced improvement in the group of patients who underwent emergency angioplasty with stenting and TIMI was 2.7 and 2.3 in the groups II and III, respectively. The analysis of ST-segment dynamics in the studied groups also showed more pronounced regression in the group of patients with PCI - 85%, then 78% in the group of patients with delayed PCI and 69% in the group of patients, where only TLT was performed.

**Tab. 2. Angiographic characteristics of the compared groups**

| Parameters                                       | I – 13 (TLT) | II – 15 (EPCI) | III – 17 (DPCI) |
|--------------------------------------------------|--------------|----------------|-----------------|
| n affected arteries                              | Didn't do    | 1,5±0,3        | 1,7±0,8         |
| Coronary index                                   | Didn't do    | 8,9±3,3        | 9,3±2,9         |
| ST segment dynamics after 90 minutes and 14 days | 69%          | 85%            | 78%             |
| TIMI blood flow                                  | Didn't do    | 2,7±0,3        | 2,3±0,5         |

The analysis of the dynamics of echoCG parameters showed that the compared groups of patients with initially comparable parameters further demonstrated different shifts of intracardiac hemodynamic criteria. For example, KDO in the group of patients who underwent TLT significantly increased from 115.8 to 132 ml, and in the group of patients after angioplasty and stenting within the first 6 hours after pain syndrome development KDO slightly increased from 117.2 to 120.8 ml, and in the group with delayed PCI from 115.4 to 126.1 ml. The CVC also underwent changes by the end of 14 days of MI. Thus, in the group with thrombolysis it increased from 55.1 to 68.3 ml, in the group with PCI it remained virtually unchanged, and in the group with delayed PCI it insignificantly increased from 55.9 to 61.8 ml. The analysis of EF dynamics also revealed similar dynamics, where the most significant decrease was observed in the TLT group. Thus, on the 14th day there was a decrease in PV from 54.8 to 46%, while in the other groups the dynamics of this index did not reach statistical significance.

The assessment of the dynamics of local contractility impairment index (LCI) showed positive significant shifts in the group of patients with emergency angioplasty and stenting. Thus, in the group of patients where ISA was recanalized within 6 hours from the onset of pain syndrome, there was a significant decrease of INLS from 1.9 to 1.69 units, while in the group of patients with TLT and delayed PCI it increased insignificantly from 1.89 to 2.0 units, and in the group of patients with delayed PCI it slightly decreased from 1.89 to 1.84 units.



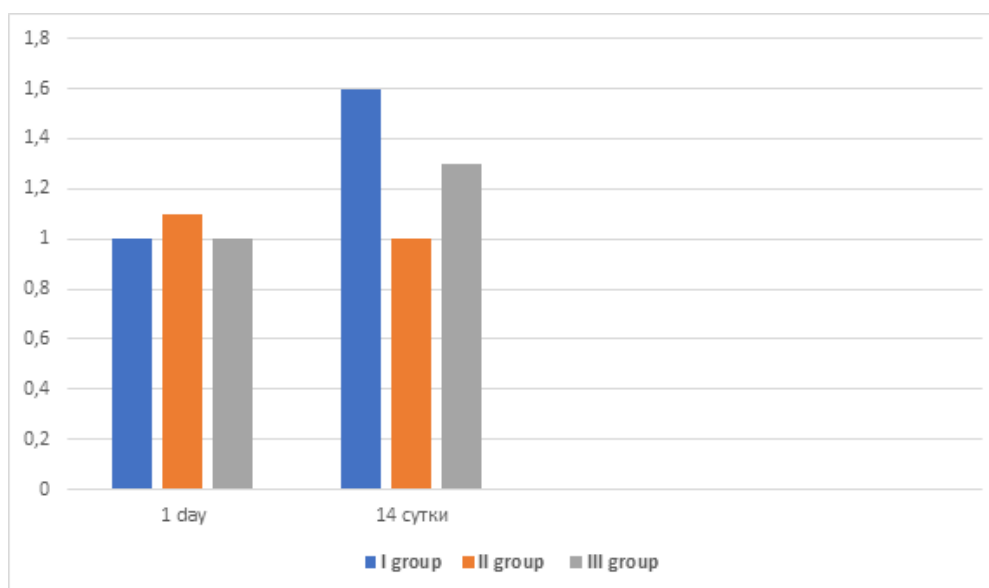
**Tab. 3 Indicators of intracardiac hemodynamics in groups in dynamics**

| Indicators | I – 13 (ТЛТ) |            | II – 15 (ЭЧКВ) |            | III – 17 (ОЧКВ) |           |
|------------|--------------|------------|----------------|------------|-----------------|-----------|
|            | 1 сутки      | 14 сутки   | 1 сутки        | 14 сутки   | 1 сутки         | 14 сутки  |
| EDV, ml    | 115,8±4,9    | 132,0±4,1* | 117,2±5,1      | 120,8±6,4  | 115,4±4,7       | 126,1±5,3 |
| ESV, ml    | 55,1±3,5     | 68,3±3,8*  | 54,9±3,6       | 55,7±4,0   | 55,9±3,3        | 61,8±4,2  |
| EF, %      | 54,8±2,6     | 46,0±1,9*  | 55,1±2,9       | 51,6±3,1   | 54,5±2,7        | 49,3±2,9  |
| LCDI       | 1,89±0,26    | 2,0±0,29   | 1,90±0,24      | 1,69±0,19* | 1,89±0,22       | 1,84±0,29 |
| IVRT, мс   | 96,2±3,1     | 81,5±2,8*  | 94,8±4,0       | 108,6±3,2* | 94,3±4,8        | 98,5±3,2  |
| DT, мс     | 153,7±5,4    | 150,9±4,9  | 157,3±5,1      | 159,7±5,6  | 155,2±4,9       | 159,3±5,4 |

\*-p<0,05 versus baseline

Analysis of IVRT showed that initially in all three compared groups its values were close to the normal values and were 96.2, 94.8 and 94.3 ms, respectively, for the three compared groups. During the 14 days of observation, different dynamics were observed in the groups with different management tactics. Thus, in the group of patients underwent TLT there was significant decrease up to 81.5 ms (p<0.05), indicating the development of restrictive type of ADLV, while in the groups with emergency and delayed angioplasty and PCI the increase was more pronounced and reached significant values in the group of emergency PCI - 108.6 ms (p<0.05).

**Pic.1 Dynamics of the E / A ratio in the studied groups**



The study of the E/A ratio revealed similar dynamics with an initially comparable ratio. Thus, on the first day in the first group, E/A was 1.0 and 1.1 and 1.0, respectively, in the second and third groups. On the 14th day of follow-up in the group with TLT there was a significant increase in this index to 1.6, indicating the worsening of DLV toward restrictive values.

**Discussion of the findings:**

The effectiveness of early coronary blood flow restoration in AMI is a proven fact and it is fair to note that this evidence base has been derived from the results of trails to study the effectiveness of TLT [5, 6]. Nevertheless, presence of hemorrhagic complications, absence of anterograde blood flow in some cases, frequency of contraindications for

TLT, promoted development and wide spread of effective method of revascularization - angioplasty and coronary artery stenting. Meta-analysis of 23 studies has proved advantages of primary transluminal balloon angioplasty with coronary stenting over TLT [7]. As mentioned above, if the effectiveness of blood flow restoration during the first hours of MI is a proven fact, then delayed PCI on ISA is a subject for discussion. Therefore, we decided to study the effect of emergency and delayed PCI on the parameters of intracardiac hemodynamics, which is the most important indicator of cardiac contractile function and reflects the degree of myocardial viability. The study included data from 45 AMI patients, who were divided into 3 groups depending on the used management tactics - TLT, emergency PCI and delayed PCI. The compared groups were initially comparable in terms of age, background diseases, degree of coronary lesion, coronary index. The analysis of ST-segment dynamics showed its more pronounced shift in the group of primary PCI, indicating effective perfusion in the lesion area.

The study of EchoCS dynamics in the compared groups showed positive dynamics of cardiac volume indices in the group of patients underwent primary PCI, whereas in the group with TLT there was statistically significant increase of CPB and CSF indices, which indicates a maladaptive type of myocardial remodeling. In the group with delayed PCI, the dynamics of these parameters took an intermediate position. As for EF dynamics, we revealed a significant worsening of this index in the group of patients with TLT, while in other groups the insignificant decrease of this index was unreliable, which can be explained by the short period of follow-up. Nevertheless, the study of INLS dynamics showed a significant improvement of contractility in the affected zone, which was reflected in a statistically significant decrease of INLS in the primary angioplasty group. Thus, our data are in agreement with the opinions of other authors about significant improvement of myocardial contractility under the influence of primary PCI [8, 9,10].

The significance of DLLF in prognosis of patients who underwent MI is proved [11]. In our work, we analyzed the dynamics of VFD in the groups with different management tactics. Thus, IVRT shortening was observed in TLT group, while in ECCV group this index significantly increased, indicating the improvement of diastolic left ventricular myocardial relaxation. Similar changes affected the group of delayed PCI, but did not reach statistical significance. Nevertheless, it indicates the benefit of delayed PCI for restoration of viability of hibernating myocardium. Thus, in patients with TLT this index increased significantly by the 14th day of follow-up, indicating the development of restrictive type of ADLV, while in PCI groups there was an improvement of this index.

**Conclusions:** thus, this study showed the advantage of primary angioplasty over delayed PCI in MI in terms of improvement of myocardial contractile function, reduction of necrosis zone. Nevertheless, delayed PCI demonstrated advantage over thrombolytic therapy with regard to the development of diastolic myocardial dysfunction, which will undoubtedly affect the improvement of life prognosis in these patients in future.



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