

## Assessment of Mental State and Speed of Psychic Perception in Patients Who Survived the 5-Year Post-Infarction Period after Thrombolytic Therapy

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**Abstract:** This work was aimed at studying the cognitive functions in patients who survived the 5-year post-infarction period after the thrombolytic therapy and the dependence of cognitive functions on structural and functional cardiac parameters. The Schulte test, MMSE and echocardiography were employed. The study comprised 58 patients who had survived the 5-year post-infarction period. 45 patients (the test group) received thrombolytic therapy with streptokinase. 13 patients (the control group) with indications for thrombolysis received the conventional therapy without the use of thrombolytic agents due to the existence of contraindications. The speed of psychic perception was impaired in almost all patients five years following the ST-elevated myocardial infarction; however, the patients after thrombolysis had signs of dementia less frequently. The correlation between the structural and functional cardiac parameters and the cognitive functions in patients five years after the myocardial infarction and thrombolytic therapy was revealed.

**Key words:** Myocardial infarction • Thrombolysis • Post-infarction period • Cognitive functions

### INTRODUCTION

MI can lead to a number of complications. Some of them are not life-threatening; however, they have significant negative effects on human health and reduce life expectancy. These complications include anxiety and depression, which emerge as a response to the traumatic effect of MI and increase the number of suicides. The frequency of cognitive impairment in postinfarction patients is appreciably high and reaches 35% [1]. According to the results obtained by A. Jefferson *et al.* [2], the frequency of dementia developed in patients have had MI is five times higher than the within-population average frequency. Meanwhile, patients with moderate cognitive impairment are more likely to have MI in their past medical history. MI is known to be most frequently preceded by atherosclerosis, which can affect both the coronary and cerebral arteries.

M. Zuidersma and co-workers conducted a study to reveal depressive disorders in 2 704 patients three months after the MI. The results demonstrated that depressive symptoms are a predictor of cardiovascular morbidity and mortality during the 10-year observation period, which emphasizes the importance of screening patients during treatment within the PIP [3].

A. Meijer and colleagues performed a meta-analysis of 29 studies conducted over the past 25 years (1975-2011) and focused upon the correlation between PIP, depression, prognosis of cardiovascular morbidity and cardiovascular events. The authors arrived at a conclusion that the postinfarction depression is associated with a 1.6-2.7-fold increase in the risk for unfavorable prognosis within the next 24 months. This relationship remains relatively stable during the next 25 years [4].

However, it should be mentioned that the frequency of detection of cognitive impairments is relatively low, which deteriorates therapy efficacy in patients during the entire PIP [5].

Whereas the cognitive functions after MI have been studied well enough, no studies devoted to the investigation of cognitive functions after thrombolytic therapy (TLT) in patients with MI have been published.

This work was aimed at studying the cognitive functions in patients who had received thrombolytic therapy and survived the 5-year post-infarction period, as well as the dependence of cognitive functions on structural and functional cardiac parameters.

## MATERIALS AND METHODS

Abbreviations. AO - aorta, IHD - ischemic heart disease, MI - myocardial infarction, EDV - end-diastolic volume, EDD - end-diastolic dimension, ESV - end-systolic volume, ESD - end-systolic dimension, LV - left ventricle, LA - left atrium, RV - right ventricle, PIP - post-infarction period, RA - right atrium, TLT - thrombolytic therapy, SV - stroke volume, EF - ejection fraction, SF - shortening fraction, ECG - electrocardiography echo-CG - echocardiography, MMSE - Mini-mental state examination.

The research subject included 58 patients who survived the 5-year post-infarction observation period. All the patients had been hospitalized 5 years ago (acute MI, prescription of pain syndrome up to 6 h and ST elevation in ECG). 45 patients (the test group) received TLT with streptokinase; 13 patients (the control group) received the conventional therapy without the use of thrombolytic agents due to contraindications.

The state of intellectual and mnestic functions was assessed using the MMSE test and Schulte tables [6]. The MMSE score was considered to be pathologically reduced (corresponding to dementia) at score of 24 and lower. The MMSE score of 21-24 corresponded to mild dementia; the score of 10-20, to moderate dementia; and the score of 9 and below, to severe dementia.

The Schulte test was considered to be pathological, when the test time was longer than 30 s, which demonstrated the deceleration of the speed of psychic perception.

The structural-geometrical parameters and the functional status of the myocardium were investigated via echo-CG in the M-mode (1D echocardiography), B-mode (2D echocardiography) and Doppler mode using a 3.5 MHz sensor in the constant and pulsed regimes and Hitachi EQB-525 and LOGIQ-7 scanners [7, 8].

The following parameters were assessed: the dimensions of cardiac structures (ESD and EDD in LV, thickness of the interventricular septum and the posterior wall of LV, dimensions of the LA and RA cavities, RV, AO size). The following parameters were calculated: ESV of LV, EDV of LV, SV in LV, EF, SF. Cross-sectional (one-moment) type of study was employed.

The statistical analysis was carried out using Statistica 6.1 software (serial number AXXR912E53722FA, StatSoft-Russia, 2009). The variables under study were characterized by irregular distribution (the Kolmogorov-Smirnov test  $< 0.05$ ). Two independent groups were

compared using the Mann-Whitney test and Z-test. The Spearman test was used to assess the correlations between two variables in the same group. The reliability of the difference score was taken into account at  $p < 0.05$ .

The study was conducted in compliance with the GMP (Good Clinical Practice) standards and principles of the Declaration of Helsinki. The study protocol was approved by the ethics committee of the E.A. Vagner Perm State Medical Academy (protocol No 74).

## RESULTS AND DISCUSSION

No differences between the MMSE score and Schulte test time were observed for the patients in the test and control group (Table 1).

Regardless of dementia severity, its frequency in the test group was lower than that in the control group (3 and 5 cases, respectively;  $p = 0.017$ ). Only mild dementia was observed among the patients in the test group; whereas 3 and 2 patients in the control group had mild and moderate degrees of dementia, respectively (no differences;  $p = 0.254$  and  $p = 0.077$ , respectively).

The pathological Schulte test scores were revealed in 44 patients (98%) in the test group and 13 patients (100%) in the control group; no differences were observed ( $p = 0.863$ ). A 1.5-2-fold increase in the test times was observed. Thus, the speed of psychic perception was significantly impaired in almost all survived patients in both groups.

The correlation between the echo-CG indicators and the MMSE test score in the test group was analyzed. A weak positive correlation between the thickness of the posterior wall of LV and MMSE test score was detected ( $r = 0.332$  at  $p = 0.026$ ), which linked the structural cardiac changes and the cognitive functions (via the changes in hemodynamics).

The relationship between the echo-CG indicators and the Schulte test time for the test group was also analyzed. A moderate positive correlation between the interventricular septum thickness and the Schulte test time was detected ( $r = 0.296$  at  $p = 0.047$ ). A moderate negative correlation was observed for ESV of LV and the Schulte test time ( $r = -0.346$  at  $p = 0.002$ ), as well as for SV and the Schulte test time ( $r = -0.314$  at  $p = 0.036$ ). This fact means that the impairment of the contractile function of the heart (in the case of calculation of ESV of LV and SV) and thickening of the interventricular septum has a negative effect on the speed of visual orientation and search reactions.

Table 1: Comparison of the results of cognitive function tests performed patients of the test ( $n = 45$ ) and control ( $n = 13$ ) groups 5 years after they had experienced MI

Indicator	Test group (median; 25-75%)	Control group (median; 25-75%)	<i>p</i>
MMSE (score)	29 (27-29)	28 (24-29)	0.113
Schulte test time (s)	105 (93-145)	120 (97-195)	0.313

Reducing the mortality rate due to the cardiovascular catastrophes is the priority direction of medicine (in particular, of cardiology) [9, 10]. Meanwhile, it should be mentioned that health problems can emerge even in patients with successful therapy outcome; these problems affect the further quality of patient's life. They are determined both by the tolerance to physical activity and by patient's cognitive functions [11, 12]. The therapy methods for MI, which have an effect not only during the acute period but also determine the further quality of patients' life to a certain extent, are of undoubted interest. This study has demonstrated that TLT allows maintaining a higher level of cognitive functions during the 5-year period, which is a rather important result for the patients. This effect is due to the better structural and functional state of patients' hearts after they receive TLT [13, 14].

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