# THE RELATIONSHIP BETWEEN THE EXPRESSION OF THE IMMUNOINFLAMMATORY RESPONSE AND CLINICAL AND INSTRUMENTAL PARAMETERS OF MYOCARDIAL ISCHEMIA AND ENDOTHELIAL DYSFUNCTION IN MICROVASCULAR ANGINA

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**Introduction.** Understanding the relationship between the immune-inflammatory response and the clinical and instrumental manifestations of microvascular angina is fundamental for clarifying the pathogenetic mechanisms of the disease and developing objective criteria for assessing its severity. Establishing correlations between immunological parameters and myocardial ischemia parameters allows us to justify the appropriateness of immunomodulatory interventions and personalize the approach to diagnosis and treatment for this patient population.

**Purpose of the study.** Оценить взаимосвязь между выраженностью иммуновоспалительного ответа и клинико-инструментальными параметрами ишемии миокарда и эндотелиальной дисфункции у пациентов с микрососудистой стенокардией.

**Materials and methods.** Correlation and regression analysis was performed between immunological parameters (IL-6, TNF-α, sVCAM-1, sICAM-1, endothelin-1, hsCRP, circulating endothelial microparticles) and data from electrocardiography, bicycle ergometry, exercise echocardiography, 24-hour ECG and blood pressure monitoring, and stress echocardiography. Parametric and nonparametric statistical analysis methods were used: Mann-Whitney test, t-test, $\chi^2$, ANOVA, Kruskal-Wallis, correlation analysis (Pearson and Spearman), and multiple regression analysis.

**Research results.** Correlation analysis revealed multiple significant relationships between immunological markers and clinical and instrumental parameters of myocardial ischemia. A strong direct correlation was established between the IL-6 level and the number of ischemic episodes per day according to Holter monitoring data ($r=0.74$, $p<0.001$). The TNF-α level significantly correlated with the degree of ST segment depression during bicycle ergometry ($r=0.68$, $p<0.001$) and the duration of ischemic episodes ($r=0.62$, $p<0.001$). The concentration of endothelin-1 showed a

close relationship with coronary reserve impairment according to stress echocardiography data (r=0.71, p<0.001) and a decrease in left ventricular ejection fraction during exercise (r=–0.58, p<0.01). Adhesion molecules sVCAM-1 and sICAM-1 significantly correlated with the severity of regional myocardial perfusion disorders according to perfusion scintigraphy data (r=0.64 and r=0.59, respectively, p<0.001). The hsCRP level showed a moderate direct correlation with systolic blood pressure (r=0.46, p<0.01) and the frequency of ventricular extrasystoles (r=0.42, p<0.05). The concentration of circulating endothelial microparticles significantly correlated with the severity of endothelial dysfunction (r=0.76, p<0.001) and the level of endothelin-1 (r=0.82, p<0.001). Multiple regression analysis revealed that the most significant predictors of ischemia severity were IL-6 (β=0.34, p<0.001), TNF-α (β=0.28, p<0.01) and endothelin-1 (β=0.31, p<0.001), which together explained 68% of the variability in clinical and instrumental parameters of ischemia. An inverse correlation was established between the level of nitric oxide (NO) and the concentration of IL-6 (r=–0.54, p<0.01), as well as between NO and TNF-α (r=–0.48, p<0.01), indicating impaired vasodilation against the background of the inflammatory response. Analysis of heart rate variability showed a significant decrease in SDNN and RMSSD in patients with high cytokine levels (r=–0.56 and r=–0.49, respectively, p<0.01), indicating an association of the immune-inflammatory response with dysfunction of the autonomic nervous system.

**Conclusion.** The immune-inflammatory response is closely linked to the clinical and instrumental manifestations of myocardial ischemia and endothelial dysfunction in microvascular angina. The identified pathogenetic relationships confirm the leading role of inflammation in the pathogenesis of the disease and substantiate the advisability of immunomodulatory interventions as a pathogenetically targeted approach to therapy.

**References:**

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