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CHRONIC CEREBRAL ISCHEMIA: MICRORNA AS MARKERS IN DIAGNOSTICS

Ubaidov Daler Saidovich, Shomurodova Dilnoza Salimovna
Samarkand State Medical University
Department of Neurology

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Abstract:

Chronic cerebral ischemia (CCI) is a progressive condition caused by insufficient blood supply to the brain, which leads to neurotrophic impairment, cognitive impairment, and an increased risk of dementia. An important role in the modern approach to the diagnosis and treatment of CCI is played by the analysis of microRNAs, which are involved in the regulation of inflammatory processes and neurotrophic responses.

Keywords: chronic cerebral ischemia (CCI), microRNA, cognitive disorders, genetic markers, diagnostics.

INTRODUCTION. Chronic cerebral ischemia (CCI) is an important neurological problem characterized by long-term disruption of blood supply to the brain. CCI is characterized by significant changes in microRNA levels, which can serve as biomarkers for diagnosis and monitoring of disease progression. Studies show that microRNAs (miRNA) play a key role in regulating ischemia-related processes. MicroRNAs are small molecules that register the expression of genes involved in various biological processes. CCI is characterized by changes in miRNA levels, which makes them potential markers for diagnosis: miR-21: regulates apoptosis and inflammation; miR-146a: participates in immune responses and protects neurons; miR-155: is associated with neuroinflammation and regulation of cellular function. In this article, we will consider the levels of various microRNAs at different stages of CCI and perform statistical processing of the data to test the significance of the results.

MATERIAL AND METHODS. We conducted a study at the neurological department of the 1st multidisciplinary clinic of the Samarkand State Medical University, which involved 90 patients diagnosed with CCI. Patients were divided into three groups depending on the stage of the disease: group I (initial stage): n = 30; group II (moderate stage): n = 30; group III (severe stage): n = 30. Distribution of participants by gender and age was similar in all three groups. The average age was 56 ± 7 years, 57% of participants were women. Quantitative PCR (qPCR) was used to quantify microRNA levels. Blood samples were extracted and processed according to standard protocols. Data were analyzed using statistical software (SPSS). To determine the significance of differences between groups, one-way ANOVA (analysis of variance) supplemented by post-hoc tests (Tukey's or Bonferroni's test) was used. The results were considered significant at $p < 0.05$.

RESULTS OF THE STUDY. The obtained results of the scientific study were as follows, which are presented in Table 1. This table presents the levels of three microRNAs - miR-21, miR-146a and miR-155 - in different groups of patients suffering from chronic cerebral ischemia (CCI), divided by stages of the disease. Each of the microRNAs has its own role in pathogenesis and can serve as a potential biomarker for assessing the condition of patients.

Table 1.

	miR-21	miR-146a	miR-155
Group I	1.5	1.2	2.0
Group II	2.0	1.5	2.5
Group III	3.0	2.0	3.5

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- miR-21: The levels of this miRNA increase from 1.5 in Group I to 3.0 in Group III, indicating its increase with disease progression.

- miR-146a: Similarly, miR-146a levels also show an increase from 1.2 in the early stage to 2.0 in the severe stage, which may indicate its role in inflammatory processes associated with CCI.

- miR-155: A similar trend is observed here, with miR-155 levels increasing from 2.0 in Group I to 3.5 in Group III, which may indicate its association with neuroinflammatory conditions and neuronal damage.

The increase in miRNA levels with disease stage suggests their potential use as diagnostic markers. The increase in miR-21, miR-146a, and miR-155 penalizes the progression of chronic cerebral ischemia and may help in determining the severity of the patient's condition. miR-21: - ANOVA: $F(2, 87) = 25.67$, $p < 0.001$. Post hoc test: all comparisons between groups are significant ($p < 0.01$). miR-146a: - ANOVA: $F(2, 87) = 15.24$, $p < 0.001$. Post hoc test: significance between Group I and II ($p = 0.013$), Group I and III ($p < 0.001$), Group II and III ($p = 0.024$). miR-155: - ANOVA: $F(2, 87) = 30.17$, $p < 0.001$. Post hoc test: all comparisons between groups are significant ($p < 0.01$).

Each of the miRNAs shows a significant increasing trend with disease progression. This may indicate their potential role in the pathogenesis of chronic cerebral ischemia and the possibility of using them as diagnostic markers. High levels of microRNAs in more severe stages of the disease can be considered as markers demonstrating an increase in pathogenetic processes such as inflammation and apoptosis, which makes them important for diagnosis and therapy. Monitoring microRNA levels allows us to identify the progression of CCI at early stages. Increased levels of miR-21, miR-146a and miR-155 directly correlate with deterioration of the condition. These molecules can be used as markers for diagnosis and assessment of the severity of CCI.

CONCLUSIONS. These studies highlight the importance of microRNAs as markers in the diagnosis of chronic cerebral ischemia. Statistically significant differences in microRNA levels at different stages of the disease confirm their role in the pathogenesis of CCI and open new horizons for diagnosis and therapy. The use of microRNAs as biomarkers can contribute to a more accurate and rapid diagnosis of CCI, which in turn will allow for appropriate treatment at the early stages of the disease. The study of microRNA levels depending on the stage of chronic cerebral ischemia confirms their significance as biomarkers. The results indicate that microRNAs can serve as a useful tool in the diagnosis and monitoring of the disease, which opens new horizons in the context of early intervention and therapy.

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