

MICRORNA PROFILE AS A BIOMARKER OF NEUROPLASTICITY AND NERVE CONDUCTION RECOVERY IN DIABETIC POLYNEUROPATHY

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Abstract: Diabetic polyneuropathy (DPN) is one of the most common and disabling complications of type 2 diabetes mellitus, characterized by progressive damage to peripheral nerves and reduced regenerative capacity. Recent research highlights the pivotal role of microRNAs (miRNAs) in regulating gene expression involved in neuroplasticity, inflammation, and remyelination. This study aimed to evaluate the expression levels of miR-21, miR-132, miR-146a, and miR-155 in patients with type 2 diabetes and to assess their relationship with clinical and neurophysiological parameters.

Keywords: diabetic polyneuropathy, microRNA, neuroplasticity, regeneration, miR-21, miR-132, miR-146a, miR-155.

Materials and Methods.

A prospective cohort study was conducted involving 100 patients with type 2 diabetes mellitus, divided into two groups: Group 1 (n=60) — patients with clinically and electrophysiologically confirmed DPN; Group 2 (n=40) — diabetic patients without neuropathy. Clinical assessment included the Toronto Clinical Scoring System (TCSS) and DN4 questionnaire. Nerve conduction studies were performed on median and peroneal nerves. Serum levels of microRNAs were quantified using qPCR normalized to U6-RNA. Biochemical parameters (HbA1c, lipid profile, CRP) were analyzed, and statistical processing was carried out using SPSS 25.0 (t-test, Spearman correlation, multiple regression).

Results.

Patients with DPN showed significantly increased expression of miR-146a and miR-155 (2.4-fold and 3.1-fold, respectively; $p < 0.01$) and decreased levels of miR-21 and miR-132 (1.8-fold and 2.2-fold; $p < 0.05$) compared to diabetic controls. Correlation analysis revealed: miR-21 ↔ peroneal nerve conduction velocity ($r = 0.52$; $p < 0.001$), miR-132 ↔ sensory response amplitude ($r = 0.46$; $p < 0.01$), miR-146a ↔ TCSS score ($r = 0.57$; $p < 0.001$), miR-155 ↔ CRP level ($r = 0.49$; $p < 0.01$). Combined regression of miR-21 and miR-146a explained up to 42% of the variability in nerve conduction velocity ($R^2 = 0.42$; $p < 0.001$).

Discussion.

The obtained data suggest that microRNAs play a critical role in the neurotrophic response during diabetic neuropathy. Increased miR-146a and miR-155 indicate activation of pro-inflammatory cascades and suppression of neurotrophins (BDNF, NGF), while decreased miR-21 and miR-132 reflect weakened regenerative mechanisms. Restoration of balance between neuroprotective and pro-inflammatory miRNAs may represent a novel therapeutic strategy for DPN.

Conclusion.

1. DPN is associated with distinct alterations in circulating miRNA profiles — increased miR-146a and miR-155, decreased miR-21 and miR-132.
2. Imbalance between neurotrophic and inflammatory miRNAs correlates with impaired nerve



conduction and disease progression.

3. The miRNA profile can serve as a biomarker of neuroplasticity and regeneration potential in diabetic neuropathy.

4. Targeted modulation of miRNA-dependent pathways offers promising prospects for personalized neuroprotective therapy.

