Prediction of repeat cyclophotocoagulation in diabetic patients with neovascular glaucoma using a neural network model

Diabetes & Vascular Diseases

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Purpose

To investigate the diagnostic significance of inflammation and intraocular blood circulation indicators in a neural network model predicting a repeated course of transscleral cyclophotocoagulation (TSC ?PC) treatment in patients with neovascular glaucoma (NVG) of diabetic origin.

Setting/Venue

“The Filatov Institute of Eye Diseases and Tissue Therapy of the National Academy of Medical Sciences of Ukraine” State Institution, Odesa, Ukraine

Methods

This included 127 patients (127 eyes; aged ?? 65.0 years) with diabetic NVG and 20 healthy individuals as an immunological control. All patients underwent TSC ?PC with a diode laser λ=810 nm. Treatment success was defined as achieving an intraocular pressure (IOP) level of ≤ 21 mmHg and maintaining or improving BCVA after 12 months of observation. Preoperative systemic immune-inflammation index (SII) and systemic inflammation response index (SIRI) were calculated. We assessed the values of volumetric pulse blood filling, determined by the rheographic coefficient (RQ, ‰), using the rheoophthalmography method. Multiple regression analysis was used to conclude the significance of treatment efficacy based on initial clinical and laboratory indicators, followed by constructing a prediction model in the neural network.

Results

From the sample observations (n=127), 83 patients (65%) experienced a reduction in IOP to ≤21 mmHg and had a stable or improved BCVA, whereas 44 patients (35%) had insufficient IOP reduction (remained >22 mmHg) and experienced a decrease in BCVA. A multiple regression analysis was performed, which identified a strong correlation coefficient. Regression results for the dependent variable (CPC repeat course) based on input parameters (SIRI, SII ? RQ) showed a significant coefficient of the determination adjusted (adjusted R^2=0.81, p=0.000) for the number of predictors in the model. The neural network was constructed using a multilayer perceptron. The development of the neural network model identified the most significant “input” parameters: SIRI (100%), RQ (85.7%), and SII (80.7%), which significantly influenced treatment success. The sensitivity of the neural network model was 100%, specificity was 30%, and the percentage of correctly predicted events during testing on the control group was 92.9%.

Conclusions

Neural network-based prediction of transscleral cyclophotocoagulation effectiveness for patients with diabetic neovascular glaucoma allows for a sufficiently accurate forecast of treatment success with a probability of 92.9%. We believe the in-time correction of systemic inflammation and intraocular blood circulation can significantly reduce intraocular pressure, preserve visual acuity, and improve the quality of life in patients with diabetic NVG after TSC CPC. Further research is required to support these findings.

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