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Polarization biomedical optics methods in the diagnosis of papillary thyroid carcinoma

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Clinical diagnosis of papillary thyroid carcinoma (PTC) usually occurs at the stage of tumor progression, accompanied by intensive processes of growth, invasion, formation of blood vessels to provide blood supply to the tumor, the structure and quantitative changes of which can be more informatively accurately assessed by polarization biomedical optics.

Objective — to substantiate the possibility of using polarization biomedical optics methods in the diagnosis of PTC based on the principles of integrative and integrated pathophysiology.

Materials and methods. Two groups of patients were studied: the control group — healthy donors (51 patients), the experimental group — patients with PTC (51 patients), who underwent a thyroid fine needle aspiration biopsy for diagnostic purposes using the fundamental idea of polarization biomedical optics with two analytical approaches — statistical and topographic (multifractal). Instrumental laser methods were used: polarization, interference, digital holographic. The statistical parameters of polarization azimuth maps, polarization azimuth of phase and multifractal spectra of digital microscopic images of native histological sections of thyroid biopsy of patients with papillary cancer were quantitatively evaluated with the determination of: Average, Dispersion, Asymmetry and Excess. The significance of differences compared to the control, taken as 100 %, was evaluated using the Student's parametric test ($p<0.05$).

Results. A significant increase in the asymmetry and excess of the polarization azimuth, a significant inhibition of the average polarization azimuth of phase digital microscopic images of native histological sections of thyroid biopsy of patients with PTC, a significant increase in the asymmetry and excess s of phase digital microscopic images of native histological sections of thyroid biopsy were revealed. A significant increase in dispersion and a probable decrease in the asymmetry and excess of multifractal spectra of polarization azimuth maps of digital microscopic images of native histological sections of thyroid biopsy of patients with PTC were shown.

Conclusions. Significant inhibition of the average azimuth of polarization of phase digital microscopic images of native histological sections of thyroid biopsy of patients with papillary cancer and significant decrease in the asymmetry and excess of multifractal spectra of polarization azimuth maps of digital microscopic images of native histological sections of thyroid biopsy of patients with papillary cancer are caused by papillary proliferation of transformed thyrocytes, as an amorphous component, in patients with papillary cancer as a result of activation of tumor progression with intensive processes of growth, invasion, and formation of blood vessels to provide blood supply to the tumor.