Porphyrazine: A Killer of Tumor Cells and an Indicator of the Therapy Effectiveness

Zagorodnikov, Nikita (School: Municipal Lyceum #28)

Photodynamic therapy (PDT) is successfully used in clinical oncology. This treatment uses photosensitizers and light of a specific wavelength. On the light, photosensitizers generate reactive oxygen species which cause the death of tumor cells. One of disadvantages of this method is selection of the light exposure dose based on the personal experience of a doctor and lack of early assessment of the therapy effectiveness. It is known that death of tumor cells under photodynamic effects is accompanied by an increase of intracellular viscosity. One of the methods to measure the viscosity is to use molecular rotors - molecules with rotating radicals. Their fluorescence lifetime strongly depends on the medium viscosity. In the present work tetrakis(4-fluorophenyl)tetracyanoporphyrazine was used as an agent for PDT and as a molecular rotor to control the effectiveness of the treatment. Dose-dependent changes of the viscosity in tumor cells were evaluated after laser irradiation at the wavelength 594 nm in doses 5 – 50 J/cm2 with porphyrazine using the microscopy method FLIM (fluorescence lifetime imaging microscopy). At doses of 25-50 J/cm2, the changes of the viscosity occurred immediately after irradiation, and its value increased 2-3 times in 4 hours and stopped growing. At low light doses, the cell response was later and insignificant. Morphological changes in cells leading to their death were observed only at high light doses when a certain value of intracellular viscosity was reached. In the future it will be possible to carry out dosimetry monitoring of PDT and predict its effectiveness in each case with porphyrazine as a viscous sensor and a photodynamic agent.