In vivo simultaneous probing of metabolism and oxygenation of tumors using FLIM and PLIM microscopy

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ABSTRACT

Tumor cells are adapted to uncontrolled proliferation under conditions of hypoxia and variable oxygen content by switching their metabolic pathways. Nevertheless, the effects of oxygen on tumor metabolism and its contribution to the metabolic heterogeneity of tumors remain unexplored.

The purpose of this study was to develop a method for simultaneous analysis of the metabolic and oxygen states of tumor cells in vivo in real time using the fluorescence lifetime imaging (FLIM) and phosphorescence lifetime imaging (PLIM).

For oxygen assessment, a new phosphorescent sensor was developed. It was tested in vitro on colorectal cancer cells upon modeling hypoxic conditions and in vivo on mouse tumor model. Metabolic imaging was based on the use of cellular autofluorescence of the cofactor NAD(P)H. Using the developed technique, a high heterogeneity of tumors in terms of oxygen and metabolic status was demonstrated in vivo. A weaker correlation was established between the level of oxygenation and metabolism in tumor cells in vivo compared to in vitro conditions [1].

The developed FLIM/PLIM dual imaging method will be useful in preclinical studies of the effect of hypoxia on the metabolic aspects of tumor progression and response to treatment.

1. Yu. Parshina, A. Komarova, et al. Int. J. Mol. Sci. 2022.

This work was supported by the Russian Science Foundation, project 20-65-46018.