Metabolic NADH/FAD/FMN FLIM and oxygen PLIM in bioenergetic alterations

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A common property during tumor development and other diseases is altered energy metabolism, which could lead to a switch between oxidative phosphorylation (OXPHOS) and glycolysis. FLIM (fluorescence lifetime imaging) of metabolic coenzymes, as NAD(P)H and FAD, is now widely accepted to be one of the most reliable diagnostic methods to determine cell metabolism and different algorithms are actually investigated to get reproducible results. It is questionable if redox state and cell metabolism correlate, which is proved in case of a constant NADH/NAD^+ pool. We will discuss the different ideas and approaches which were published so far and present new results in metabolic imaging considering the FLIM based NADH metabolic index as well as fluorescence lifetime induced redox ratio (FLIRR) based calculations including NADH, FAD and FMN. In addition, the phosphorescence lifetime of newly developed drugs will be used to demonstrate oxygen levels in PLIM (phosphorescence lifetime imaging) techniques. In conclusion, simultaneous imaging of phosphorescence and fluorescence lifetime parameters enables complex analysis of bioenergetic alterations.

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