In vitro biochemical classification of brain tumors by high field ^{1}H MRS

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Hydrogen magnetic resonance spectroscopy (^{1}H MRS) performed at low fields is a non-invasive method and a useful tool for the diagnosis of tumors *in vivo*. High field ^{1}H MRS, on the other hand, has been used to study biochemical changes in distinct pathologies *in vitro* based on the pattern of metabolite distribution in tissue extracts. It is also useful for identifying the distinct metabolic profiles of specific histological subtypes of brain tumors, aiming for the optimization of the *in vivo* ^{1}H NMR spectroscopy protocols. The accurate analysis and classification of different spectra, however, remains a challenge. In this work, brain tissue samples from patients with various types of brain tumors were analyzed by high field (B_0 = 11.7) ^{1}H MRS in the region 1.22 – 4.25 ppm. Spectra were corrected to phase shift, baseline corrected using a linear fit and point wise scaled by the sum of all intensities (normalized to unit area).

Partial Least Square Discriminant Analysis (PLS-DA) on autoscaled data revealed a tendency of high-grade neuroglial tumors in increasing glycine and glutamine/glutamate and decreasing myo-inositol. Creatine and NAA were clearly decreased in non-neuroglial tumors and alanine was higher in non-neuroglial tumor followed by high-grade neuroglial tumors. Choline compounds had a particular distribution in metastasis and non-neuroglial tumors with increasing of GPC peak and decreasing of PC peak when compared with neuroglial tumors and controls. None or at most one sample was misclassified during the leave-one-out crossvalidation procedure. These results allowed brain tumors to be grouped according to their specific histological subtypes and degree of aggressiveness, reflecting particular characteristics of tumor original cell and neoplastic cells's metabolic abnormalities possibly related to high turnover, resistance to apoptosis, osmotic stress and their tendency to aerobic glycolisis.

Acknowledgment. FAPESP, CNPq.