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Analysis of human glioma by FFC NMR

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FFC NMR shows promising results in the context of medicine. Several studies[1-4] have explored the information available from FFC NMR in various pathologies and isolated several potential biomarkers, in particular in cancer.

One striking feature of the T_1 dispersion curve in cancer is the dramatic change of shape between normal and tumorous tissues: while healthy tissues usually exhibit Lorentzian-like dispersion profiles, tumours systematically show two or three power-law dispersions. This has been observed in breast carcinoma and musculoskeletal sarcoma, and indicates that the main longitudinal relaxation process changes during the course of cancer development, probably in favour of a relaxation process based on interaction between water and the extra-cellular protein matrix.

This study focused on validating the use of FFC NMR in the context of human glioma. We studied eight samples of human frozen brain resections obtained from glioma or epileptic surgery. The samples were sliced by microtome, separated into white and grey matter, homogenised in NMR tubes and covered with Flomblin (Sigma-Aldrich) to prevent evaporation. The dispersion measurements were performed at 37 °C on a SpinMaster relaxometer (Stelar, Italy) and the results were compared with MALDI imaging. The relaxometry data were analysed using the new model developed by Fries and Belorizky[5] for the quadrupolar peaks together with a power law background.

The results indicate clear differences between white and grey matter, as expected, as well as large differences between patient tumours, but no clear correlation was observed so far with tumour grade. In addition to this, the shape of the dispersion curve in glioma differs from that observed in other tumour types (breast carcinoma and musculoskeletal sarcoma) and its background frequency dispersion only follows a single power law. These results are encouraging, but indicate that probably the homogenisation of the brain tissues is having a detrimental effect on the tissue contrast.

Further work is planned to analyse non-homogenised samples from mice and human tumours obtained from cryosections.

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