

Metabolic characterization of primary human colorectal cancers using high resolution magic angle spinning ^1H magnetic resonance spectroscopy

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Introduction

Colorectal cancer is one of the most frequent and most lethal forms of cancer in the western world. The aim of this study is to characterize by ^1H high resolution magic angle spinning nuclear magnetic resonance spectroscopy (HRMAS NMR) the metabolic fingerprint of both tumoral and healthy tissue samples obtained from a cohort of patients affected by primary colorectal adenocarcinoma.

Materials and methods

Between March 2007 and December 2007, 44 patients (26 men, 18 women; mean age: 68 \pm 12 y, age range: 45-90 y) with histologically proven colorectal adenocarcinoma were prospectively selected in the university hospital of Strasbourg, France. All patients underwent a surgical resection of the primary lesion and a radical lymphadenectomy. Each biopsy sample was prepared for the ^1H HRMAS NMR analysis by introducing 15 to 20 mg of biopsy into a disposable 30 μl insert. Samples were spun at the magic angle (54.7°) at 3502 Hz and the time of analysis was about 20 min.

Results and discussion

Representative HRMAS magnetic resonance spectra of adenocarcinomas and healthy tissues originating from the same patient are presented in Figure 1. About 35 metabolites could be unambiguously detected in these spectra. Analyzing these metabolic data using multivariate statistical analysis (PLS-DA) allowed discriminating the two types of tissues with a high level of confidence (Figure 2). An elevated amount of glutamate, taurine, lactate and aspartate in a colorectal biopsy is symptomatic of an adenocarcinoma while a high amount of myo-inositol and β -glucose is a signature of a healthy tissue.

Conclusions

Adenocarcinomas can be separated from control colon tissues in a robust and statistically significant manner using a multivariate statistical analysis of the magnetic resonance detected metabolic content of each biopsy.

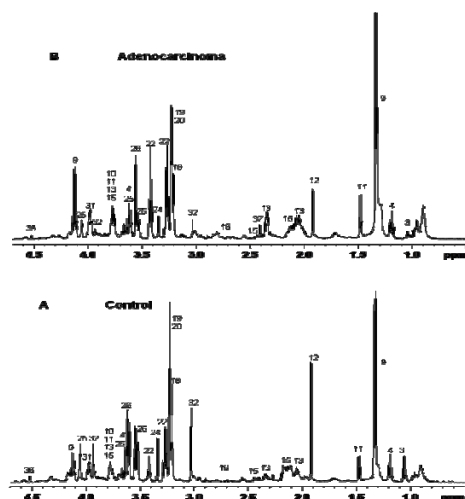


Figure 1: ^1H 1D HRMAS NMR spectra of a control colon biopsy and of an adenocarcinoma

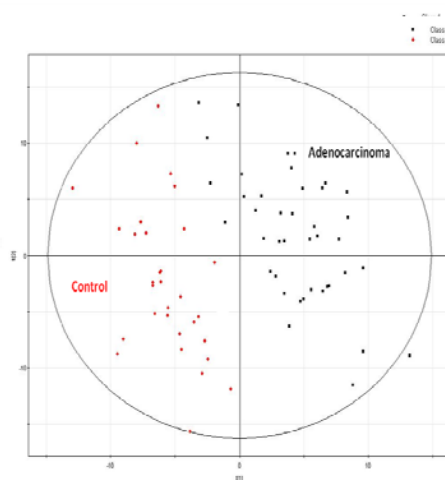


Figure 2: Score plot of a PLS-DA analysis showing the discrimination that can be achieved between control biopsies and adenocarcinomas using only metabolic information