MRS in Cancer Research

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MRS, either in its single voxel (SV) version or in its multivoxel flavour (MRSI/CSI) has been used for a long time to study cancer [1]. Nowadays, the type of questions that basic scientists but specially clinicians would like to address non-invasively using MRS would be: early detection, differential diagnosis, prognostic assessment, and therapy response monitoring, but not necessarily in this order of priority. Early MRS work used the 31P nucleus [1] and this still provides interesting information for example on therapy response [2-3]. Nevertheless, most in vivo work since then has concentrated in using 1H [4-5]]. This may drift in the near future towards 13C-based molecular imaging thanks to the hyperpolarisation-based signal increase [6-7].

Data analysis and data display are relevant aspects in the ability of researchers to profit from the information contained in those MRS studies. In favourable cases, detection of a certain signal “total choline” and its (relative) quantification may be indicative of tumour presence, aggressive character and response to therapy. This may be the case for breast cancer [8-9]. In other instances, restricted spectral regions or ratios of them may have diagnostic or prognostic interest, as in brain cancer [10-11]. Sophisticated metabolite quantification strategies are also available for MRS pattern full analysis [12] although they do not necessarily provide an immediate answer to the clinically relevant question. For this, additional multiparametric data analysis may be needed [13, 4-5] and strategies for its display required [5, 14-16].

Translating cancer research into targeted therapeutics is a relevant subject that was recently reviewed [17]. One of the items in the wish list of the authors was minimally invasive intermediate endpoint biomarkers of tumour response to treatment. This is an item in which MRS seems to be able to contribute. Lactate and/or total choline content seem to decrease upon therapy response in tumours as judged by 1H MRS studies [8-9, 18], while the lactate/pyruvate ratio sampled from 13C hyperpolarized pyruvate infusion studies (possibly sensing lactate DH activity) decreases upon tumour response in preclinical xenograft lymphoma tumours [6].

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