Reliable estimate of lactate and lipid for newly-diagnosed gliomas patients using lactate-edited 3D 1H-MRSI with ellipsoidal k-space sampling

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A robust and practical acquisition was developed in order to reliably estimate lactate and lipid levels in glioma patients. This combined J-difference modulation and reduced k-space sampling to obtain 3D 1H-MRSI data. Thirteen pre-treatment glioma patients were studied. Preliminary results concerning the spatial distribution of lactate and lipid are presented and compared with estimates of rCBV obtained using dynamic perfusion weighted MR imaging.

RESULTS

Blood Volume) was derived from the dynamic dataset and normalized to contralateral normal-look white matters [3]. Lac and Lip with height more than twice of the noise standard deviation were defined as significant and contours were generated. rCBV (regional Cerebral Blood Volume) was derived from the dynamic dataset and normalized to contralateral normal-look white matters [3]. Lac and Lip with height more than twice of the noise standard deviation were defined as significant and contours were generated.  rCBV (regional Cerebral Blood Volume) was derived from the dynamic dataset and normalized to contralateral normal-look white matters [3].

DISCUSSION

Although the nominal voxel size of the reduced k-space acquisition used in this study was the same as that with cubic acquisition, simulations indicated that the true voxel size was around 40% larger than the latter and that less Gibbs ringing artifacts were obtained when imaging circularly limited objects such as the head [4]. Significantly elevated lactate was observed in a high proportion of the low grade patients, which suggests that it cannot be considered as a characteristic of just high grade gliomas. Increased lactate may occur when the lactate-producing anaerobic glycolytic pathway exceeds the capacity of the lactate-catabolizing respiratory pathways or when the cellular capacity for exporting lactate to the bloodstream is impaired. Thus lactate presence is expected to be a strong indicator of hypoxia or poor perfusion in the lesion. We hypothesize that high lactate levels in pre-treatment lesions will predict radio-resistance and a poor outcome. Mobile lipids were observed in all of the high grade lesions followed in this study. Higher rCBV was observed in the lipid regions and lower rCBV in regions with lactate. One possible explanation is that the hypoxia, as indicated by high lactate, occurs prior to tumor angiogenesis, whereas the lipid arises during and after angiogenesis and indicates the presence of macro- and micro-necrosis that can be induced by both tumor and treatment. This suggests that studying lactate and lipid signals may be important for providing information about tumor progression.

REFERENCES


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