Growth Related Changes of Phosphorous Metabolites in VX2 Carcinoma Implanted into Rabbit Thigh Muscle: *in vivo* ^{31}P MRS

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Purpose: To evaluate *in vivo* 31-phosphorous(^{31}P) MRS for non-invasive monitoring of growth-related phosphorous metabolite changes from VX2 carcinoma implanted into rabbit thigh muscle.

Materials and Method: Thirty rabbits(2-3kg; mean 2.7kg) were examined. During different stages of tumor growth, VX2 carcinoma was implanted into a rabbit thigh muscle from carrier rabbit with VX2 carcinoma(1-10weeks after implantation; 3 rabbits per each stage) and then anesthetized with a dose of 4ml injection(ketamine:rompun=7:1). All MRI and ^{31}P MRS studies were performed on 1.5T Signa Horizon Echospeed MR scanner(GE Medical Systems, Milwaukee, U. S. A.) using 8 inch(transmit) and 5 inch(receive) diameter flat type surface coil. T1-weighted (TR/TE= 500/8ms) and T2-weighted FSE images (TR/TE= 3200/102ms) were used to position the animals and obtain reference anatomical images. The free induction decay chemical shift image(FIDCSI: TR= 5000ms) with 192 scans was used to acquire the MRS data from the localized single-voxel in the tumor mass.

Results: The size of tumors(cm) and the volume of necrotic portion(percentage) in the tumors were proportionally increased with tumor growing. Time course variation of the phosphorus metabolites associated with VX2 carcinoma were analyzed by *in vivo* ^{31}P MRS, and intracellular pH was also evaluated. *In vivo* ^{31}P MR spectral changes constitute increasing signals from PME, Pi, and PDE over the time course from 3-4weeks after implantation of VX2 carcinoma. And changes of signals from PME, Pi, and PDE correlated positively with the percentage of tumor necrosis. The intracellular pH continuously decreased corresponding to the time period of tumor growth and to the percentage of tumor necrosis. There was no significant changes of signals from PCr and γ, α, and β-ATP with tumor growth.

Conclusion: It is concluded that in vivo 31P MRS is capable of noninvasively monitoring tumor growth by presenting the phosphorus metabolites, such as PME, Pi, and PDE, and by determining of intracellular pH, and may be having potential value in monitoring effects of tumor therapy *in vivo*.