

Proton MR spectroscopy of Ovarian Tumors at 3T: Differentiation of Benign and Malignant Solid Components of Ovarian Tumors

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[Introduction] The ovaries are located deeply in the pelvic cavity and percutaneous biopsy is not commonly performed for ovarian tumors, so preoperative diagnosis based on imaging is important. Ovarian tumors may exhibit various morphologic appearances, and specific diagnosis on MR imaging is often difficult. However contrast-enhanced solid component may suggest ovarian cancer, it is not always easy to differentiate ovarian cancers from benign ovarian lesions with solid components based on routine MR imaging. 1-H MR spectroscopy (MRS) provides metabolic information, and may add valuable information for the diagnosis. The choline peak (3.2 ppm) may be observed in solid tumoral components reflecting metabolic activity of tumor cells and tend to show higher peaks in malignant tumors. In gynecologic tumors, Takeuchi et al. reported that the choline concentration was significantly higher in malignant uterine corpus tumors than in benign lesions (Eur Radiol 21; 2011). The purpose of this study is to verify the feasibility of MRS at 3T to differentiate benign and malignant solid components of ovarian tumors.

[Materials and Methods] Pathologically diagnosed ovarian solid, or complex solid and cystic masses were retrospectively evaluated. MRS (PRESS, TR/TE = 2000ms/144ms) was performed in all subjects on a system with a 3T superconducting units (Signa HDx 3T, General Electric, Milwaukee, WI) with 8ch body-array torso coils. Single voxel of interest (VOI=8ml) was placed within the tumors so as not to contain cystic or necrotic areas as much as possible by referring T1WI, T2WI and DWI. Quantitative evaluation of the choline concentration was made by using LCModel (Stephen Provencher Inc.) on the workstation. The criteria for selecting reliable metabolite concentrations were based on the %SD of the fit for each metabolite and only results with a %SD <20% (46 ovarian tumors including 11 benign and 35 malignant/borderline malignant tumors) were included in the analysis. Mann-Whitney's U test was used to compare the choline concentration among benign and malignant ovarian tumors. A value of p<0.05 was considered statistically significant. The choline concentration cut off value (mM) to differentiate benign from malignant lesions was calculated, with their sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV).

[Results] The choline concentration in malignancy (6.71 +/- 5.01 mM, n=35) was slight higher than that in benign lesions (5.48 +/- 4.77 mM, n=11), but not statistically significant (p>0.05). By referring contrast-enhanced images obtained after MRS measurement, malignant lesions with low choline concentration tended to show solid and cystic nature or contain necrotic areas in VOI for MRS measurement (Fig. 1). 14 malignancies with cystic or necrotic areas in VOI were excluded, and the choline concentration in 21 malignant tumors with predominantly solid nature in VOI was 9.47 +/- 4.66 mM, which was significantly higher than that in benign lesions (p<0.05) (Fig. 4). Using a cut off value of 6 mM for malignant lesions had a sensitivity of 81%, specificity of 73%, PPV of 85%, and NPV of 67%.

[Conclusions] We conclude that MRS with quantitative evaluation of the choline concentration in solid components of ovarian tumors can provide helpful information in distinguishing benign and malignant ovarian tumors. However, malignant tumors showing solid and cystic nature or containing necrotic areas tended to show lower choline concentration.

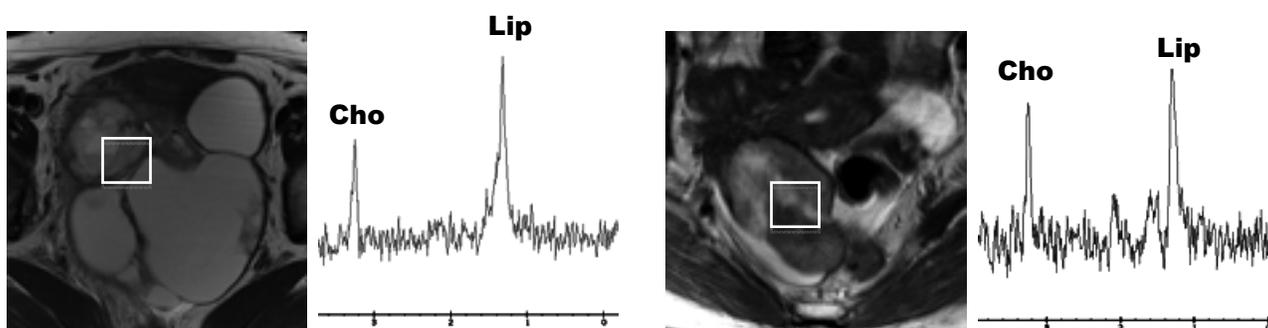


Fig. 1: Ovarian metastasis from breast cancer showing solid and cystic nature shows choline peak on MRS but relative low concentration (2.29 mM).

Fig. 2: Thecoma showing solid nature shows choline peak on MRS but relative low concentration (2.85 mM).

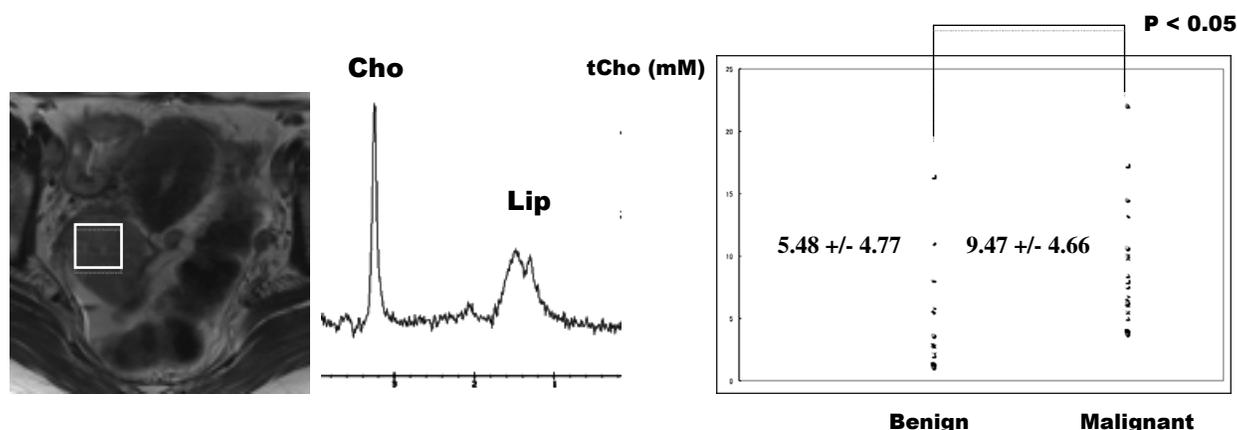


Fig. 3: Undifferentiated carcinoma showing solid nature shows high choline peak on MRS and high concentration (10.7 mM).

Fig. 4: Scatter plots of the choline concentration obtained in benign and malignant ovarian tumors with predominantly solid nature in VOI.