

Value of diffusion-weighted images in ovarian tumors

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Introduction

Recently prevailing diffusion-weighted imaging (DWI) depicts tissue characteristics based on diffusion motion of water protons. On DWI, a variety of solid tumors has been known to show increased signal intensity due to restricted diffusion in the tumors. The purpose of this study is to investigate value of DWI for detecting ovarian tumors, peritoneal implants, and metastatic lymphadenopathy and for differentiating benignancy and malignancy, comparing T2WI and fusion images with DWI onto T2WI.

Materials and Methods

Our study population consists of 33 patients of surgically confirmed ovarian tumors. Histologic diagnosis in these patients were 17 ovarian cancers (serous adenocarcinoma 8, endometrioid carcinoma 4, clear cell carcinoma 4, mucinous cystadenocarcinoma 1), 3 tumors of borderline malignancy (serous tumor 1, mucinous tumor 1, Brenner tumor 1) and 12 benign tumors (cystadenoma 2, dermoid cyst 4, endometrial cyst 6). Bilateral lesions were seen in 8 patients (serous adenocarcinoma 4, endometrioid carcinoma 1, mucinous borderline tumor 1, endometrioma 2)

MR imaging was performed using a 1.5- MR imaging unit (Symphony, Siemens Medical Systems, Erlangen, Germany) with a phased-array body coil. Initially, sagittal T1- and T2-weighted fast spin-echo images were obtained for defining anatomy and localizing the tumor. Then sagittal DWI with same plane was obtained utilizing single shot echo-planar sequence (TR/TE=2300/75, b factors of 0, 500 and 1000(s/mm²), SENSE factor of 2 and fat suppression with CHESSE technique. These MR images were uniformed with a section thickness of 5 mm, intersection gap of 1.5mm, and a field of view of 260 mm. When abnormal signal intensity was detected on DWI, fusion images onto T2WI were also created for anatomic recognition by fusion software (Aquarius Net, Teraricon). The MR images were independently evaluated by two radiologists blinded for histologic diagnosis and surgical results, regarding the presence of abnormal intensity in the tumor, peritoneal implants and lymphadenopathy. The results of MR imaging were compared with surgical findings and histologic diagnosis.

Results

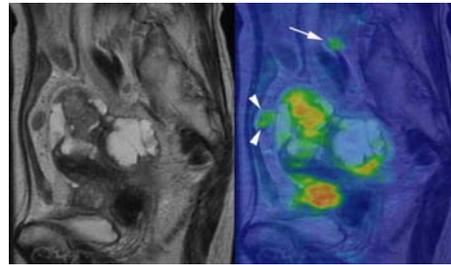
On DWI, abnormal signal was observed in all ovarian cancers while no signal was observed in benign cystadenomas and all borderline tumors. However, either focal or diffuse high intensity was seen all endometrioma and dermoid cysts. Surgery confirmed 60 macroscopic implants in 10 patients. The fusion images with DWI could successfully detect all 60 lesions. However, T2-weighted images could demonstrate 36 lesions. Histologic examination following the surgery revealed six metastatic lymph nodes in two patients. The fusion images with DWI could demonstrate all of the metastatic nodes, while T2-weighted images demonstrated only two metastatic nodes.

Discussions

Our study shows that DWI is useful technique not only for demonstrating ovarian cancers, but also for detecting peritoneal disease and metastatic nodes. The superiority of DWI to T2WI for detecting peritoneal implants may be due to excellent tissue contrast of DWI. However, the diagnosis should depend on the signal pattern on T1WI and T2WI, since some benign ovarian tumors such as endometrial cysts and dermoid cysts can also exhibits increased signal intensity on DWI either entirely or focally. The cause of signal in both endometrial cysts and teratomas are considered to represent restricted water diffusion in highly sticky fluid in these lesions. However, these benign cysts can be confirmatively diagnosed on usual T1WI and T2WI.

Conclusion

DWI is useful modality for demonstrating ovarian cancer as foci of increased intensity. However, T1WI and T2WI should be referenced for the diagnosis of ovarian cancer, since benign endometrioma and dermoid cyst can also show high intensity. DWI is superior to T2WI in demonstrating peritoneal implants and metastatic lymphadenopathy.



Figure; 58 year old women with serous adenocarcinoma of the ovary.

T2WI (left) demonstrates ovarian tumor of heterogeneous appearance with solid and cystic components, and peritoneal implant in uterovesical fossa. In addition to these lesions, fusion image with DWI onto T2WI (right) demonstrates increased intensity in paraaortic metastatic node (arrow) and another implant (arrowhead), which resemble intestine on T2WI.