

## Hypointense Malignant Ovarian Tumors on T2-weighted Images: MR-Pathologic Correlation

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**[Introduction]** Hypointensity on T2-weighted MR images is an unusual finding of ovarian tumors and form a special diagnostic category. These lesions have some histopathologic characteristics which shorten the T2 relaxation time of tissues and help to make differential diagnosis. Dense fibrous stromal proliferation in sex cord-stromal tumors such as fibromas, thecomas and sclerosing stromal tumors may cause hypointensity of the solid tumoral component. Hypointense malignant tumors of the ovary on T2-weighted images are very rare but to diagnose these lesions is important because hypointensity on T2-weighted images may usually suggests its benign nature. In this study we evaluated such rare ovarian malignant tumors with pathologic correlation.

**[Materials and Methods]** Surgically proven six malignant ovarian tumors which showed totally or partially very hypointensity (equal to skeletal muscle) on T2-weighted images were reviewed retrospectively with pathologic correlation. MR images were obtained with 0.5-1.5 Tesla superconducting systems. The pathologies were as follows: Mucinous cystadenocarcinoma, clear cell carcinoma (solid variant), Krukenberg's tumor, malignant carcinoid tumor, malignant Brenner tumor, and choriocarcinoma.

**[Results]** The Mechanisms of T2 shortening of the pathologies were as follows: 1) primary and secondary ovarian stromal proliferation of the tumors, and 2) mucinous, viscid proteinous material and/or coagulated necrosis.

1) T2 shortening due to dense collagenous tissue was observed in Krukenberg's tumor (Fig. 1) with reactive stromal proliferation stimulated by the metastatic signet-ring tumor cells, and in malignant carcinoid tumor (Fig. 2) with primary neoplastic stromal proliferation. Mucinous materials, edematous change and cyst formation in Krukenberg's tumor made the signal intensity of the tumor inhomogeneous and complicated. Malignant carcinoid tumor was composed with hypointense solid components and multilocular cystic components. Hypervascularity on arterial phase of dynamic study, which may be general imaging characteristics of endocrine tumors, was demonstrated. Malignant Brenner tumor (Fig. 3) was composed with hypointense and slight hyperintense solid components in a unilocular cystic mass. Hypointense areas were composed with dense collagenous tissue and scattered small nests of transitional cells, and hyperintense areas were transitional cell carcinoma resulting in malignant transformation of benign Brenner tumor. Admixture of benign and malignant components is characteristics of malignant Brenner tumor and admixture of hypointense and hyperintense solid components may well reflect its pathologic feature.

2) Mucinous contents within the meshes of papillary growing tumor cells in mucinous cystadenocarcinoma (Fig. 4), coagulated necrotic tissues within the small cystic spaces formed by the delicate fibrous trabeculae supporting the tumor cells in solid variant of clear cell carcinoma (Fig. 5), and coagulated necrotic and hemorrhagic background tissues in which syncytial tumor cells are scattered in choriocarcinoma (Fig. 6) showed hypointensity of these tumors. Reticular enhancement of mucinous cystadenocarcinoma, and of clear cell carcinoma reflected the meshes of tumor cells, and the delicate fibrous trabeculae, respectively. Hyperintense hemorrhagic changes on T1-weighted images and marked necrotic areas revealed on post-contrast T1-weighted images may be common imaging findings in malignant germ cell tumors. Elevated serum hCG level was helpful for the diagnosis of this patient.

**[Conclusions]** Preoperative diagnosis of these rare malignant ovarian tumors, which show hypointensity on T2-weighted MR images, from benign sex-cord stromal tumors is important and should be made by their characteristic clinical and imaging findings.



Fig. 1

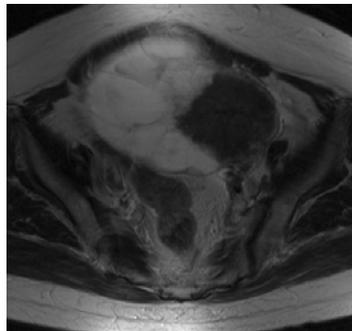


Fig. 2



Fig. 3



Fig. 4

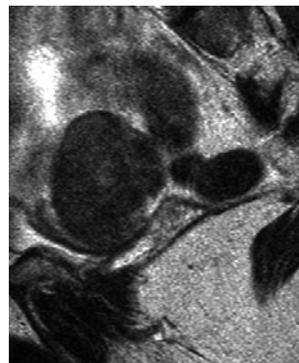


Fig. 5

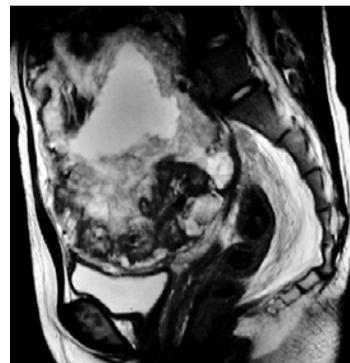


Fig. 6