

MR Imaging Findings of Ovarian Cystadenofibroma and Cystadenocarcinofibroma: Clues for the Differential Diagnosis

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Objective: We wanted to assess the MR imaging findings of ovarian cystadenofibroma and cystadenocarcinofibroma, and we wanted to find clues for making the differential diagnosis between them.

Materials and Methods: The MR images of 12 pathologically proven cystadenofibromas and two cystadenocarcinofibromas were reviewed, with a focus on the internal architecture, signal intensity and enhancement.

Results: All the tumors appeared as multilocular cysts, except for a single unilocular cystic mass and a single solid mass. The previously reported characteristic MR findings of cystadenofibroma (a multilocular cystic mass with a T2-dark-signal-intensity solid component containing small cystic locules) were found in only 43% of the tumors (6/14). Diffuse or partial thickening of the cyst wall with T2-dark signal intensity without a definite solid component was as common as the previous reported findings (6/14). Two cystadenocarcinofibromas showed more prominent solid portions with higher T2-signal intensities and stronger enhancement than did the cystadenofibromas.

Conclusion: Diffuse or partial thickening of the cyst wall with dark-signal-intensity in multilocular cystic masses may suggest ovarian cystadenofibroma, and this type of appearance may be as common as the previously reported characteristic appearance. A prominent solid component with a higher T2-signal intensity and strong enhancement are the typical findings of cystadenocarcinofibroma.

Ovarian cystadenofibroma (CAF) is a benign tumor that contains both epithelial and stromal components. It is rarely malignant, but it often mimics malignancy on imaging, and this mainly due to a well-enhancing solid component in the cystic mass (1–4). Outwater et al. reported that this solid component shows low signal intensity similar to skeletal muscle on the T2-weighted MR images because of the presence of fibrous tissue (5). Takeuchi et al. also reported that small or tiny cystic locules within this solid component are the characteristic findings of CAF, and they correspond to a black sponge-like appearance on the T2-weighted image (6). However, these findings are not specific and they may not be evident on all cases. We have encountered several cases of CAF that show different MR imaging findings from the previous characteristic findings.

Cystadenocarcinofibroma (CACF) is the malignant counterpart of the CAF. CACF is very rare and there is no report of the MR imaging findings of this tumor in the literatures. We have recently encountered two cases of CACF.

The purpose of this study was to assess the MR imaging findings of ovarian CAF and CACF, and we wanted to find clues for making the differential diagnosis between them.

MATERIALS AND METHODS

Twelve pathologically confirmed cases of CAF in 11 patients and two cases of CACF were included in this study. The ages of the patients ranged from 24 to 62 years (mean age: 48 years).

All the MR imagings were performed using 1.5 or 3 Tesla (T) units. The patients were scanned with a variety of fast spin-echo (or turbo spine echo) pulse sequences that were optimized for the MR imaging unit and for the patients' body parameters. The routine sequence consisted of the sagittal and axial T2-weighted images, and these were followed by the axial T1-weighted images. The fat saturated and contrast enhanced T1-weighted images were also obtained.

Three radiologists, who were unaware of the histopathologic diagnoses, reviewed the MR images. The following findings were analyzed: 1) the morphology, size, location and internal architecture of the tumor, 2) the characteristics of the signal intensity, and 3) the contrast enhancement pattern of the tumor. The signal intensities of the internal structures on the T2-weighted sequences were classified as low (similar to muscle), intermediate (similar to myometrium), or high (similar to simple fluid). The degrees of contrast enhancement on the MR images were assessed and then compared with that of the normal uterine myometrium, and they were classified as none, mild (less than myometrium), moderate (equal to myometrium), or marked (greater than myometrium). The findings were determined by a consensus of the three experienced radiologists.

RESULTS

The results are summarized in Table 1. Among the 13 patients, 12 patients had unilateral lesions and one had bilateral lesions. The tumor sizes ranged from 1.9 to 23.0 cm (mean; 7.4 cm) at the longest diameter. The margins of all the tumors were well defined with smooth borders. The histologic types were serous in eight, mucinous in five, and endometrioid type in one.

All the tumors appeared as multilocular cysts, except for a single unilocular cystic mass and a single solid mass. The previously reported characteristic MR findings of CAF (a multilocular cystic mass with a T2-dark-signal-intensity and a solid component containing small cystic locules) were found for only 43% of the tumors (6/14) (Figs. 1, 2). Diffuse or partial thickening of the cyst wall with T2-dark signal intensity and without a definite solid component were the findings like the previous findings (6/14) (Figs. 3, 4). Circumferential wall thickening and partial wall thickening were visible not only along the frequency encoding direction, but also along the phase encoding direction on the MR images, which means this dark-wall-thickening was not caused by a chemical shift artifact.

Two CACFs had a markedly enhancing solid component that showed intermediate signal intensity on the T2-weighted images. The signal intensities of the solid portions on the T2-weighted images were higher than those of their benign counterparts (Figs. 5, 6). However, there was no significant difference in the tumor size and margins between the CAF and CACF. Lymphatic metastasis or ascites was not evident in the CACF.

Table 1. MR Imaging and the Pathologic Features of 14 Tumors

| No | Age | Size(cm) | Pathology | Internal Structure | Solid Component | | | Dark Signal Intensity Wall |
|----|-----|----------|-----------|-------------------------------|-----------------|----------------|-------------|----------------------------|
| | | | | | T2 Signal | Cystic Locules | Enhancement | |
| 1 | 43 | 6.2 | Malignant | Mainly solid | Intermediate | + | Marked | |
| 2 | 62 | 7.5 | Malignant | | Intermediate | + | Marked | |
| 3 | 54 | 8.5 | Benign | | Low | + | Marked | |
| 4 | 42 | 9.2 | Benign | Multilocular cyst | Low | + | Mild | |
| 5 | 48 | 8.0 | Benign | with solid component | Low | + | Mild | |
| 6 | 56 | 15.0 | Benign | | Low | + | Mild | |
| 7 | 24 | 23.0 | Benign | | Low | + | Mild | |
| 8 | 61 | 5.5 | Benign | | | | | + |
| 9 | 58 | 2.7 | Benign | | | | | + |
| 10 | 58 | 6.0 | Benign | Multilocular cyst | | | | + |
| 11 | 55 | 5.5 | Benign | with irregular wall component | | | | + |
| 12 | 36 | 3.5 | Benign | | | | | + |
| 13 | 61 | 11.0 | Benign | | | | | + |
| 14 | 25 | 1.9 | Benign | Unilocular cyst | | | | |

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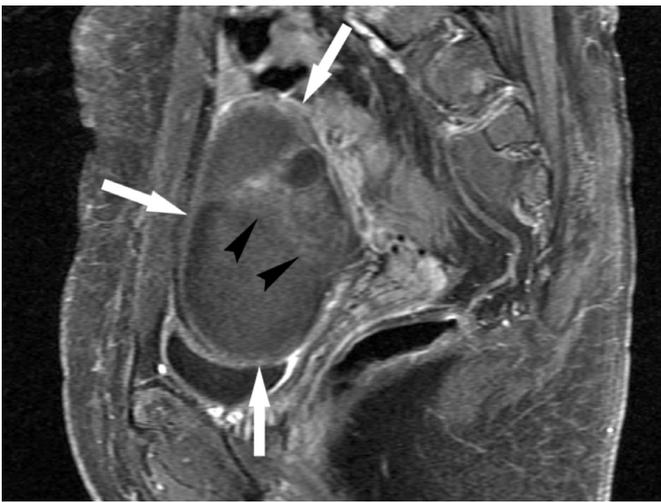
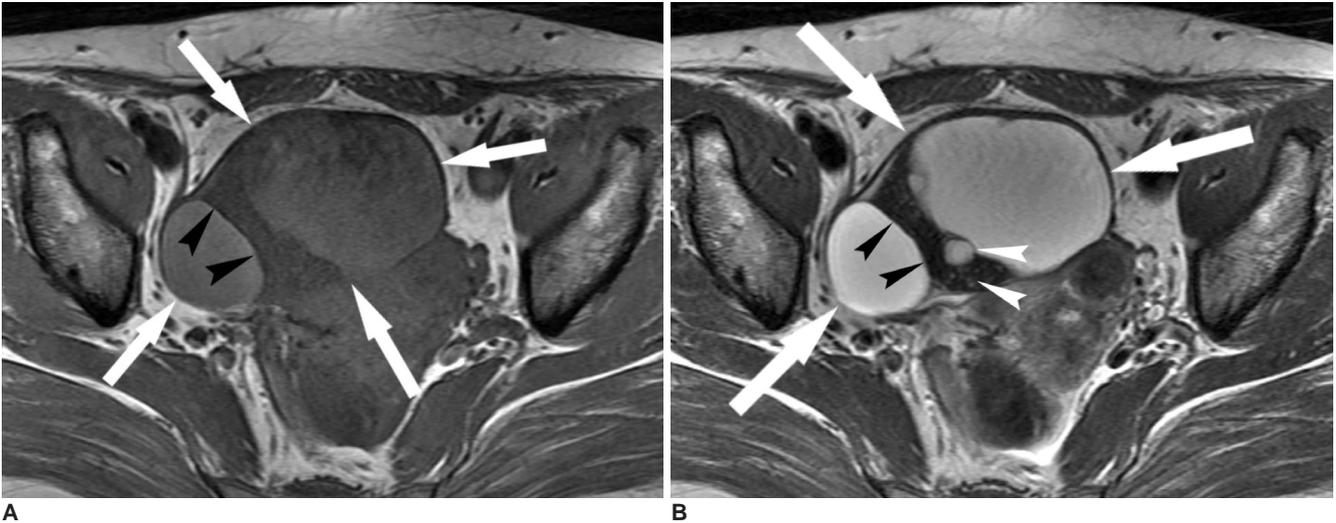


Fig. 1. A 42-year-old woman with a mucinous cystadenofibroma. The T1- (A) and T2-weighted (B) MR images show a multilocular cystic mass with a solid component (arrows) in the right ovary. The solid component (black arrowheads) shows low signal intensity and it contains multiple, small cystic locules (white arrowheads). C. The contrast-enhanced T1-weighted sagittal MR image with fat-suppression shows mild enhancement in the solid component (arrowheads) within mass (arrows).



Fig. 2. A 24-year-old woman with a mucinous cystadenofibroma. A. The T2-weighted sagittal MR image shows a huge multilocular cystic mass (arrows) with a solid component in the left ovary. The solid component with low signal intensity contains small cystic locules (arrowheads). B. The contrast-enhanced T1-weighted sagittal MR image with fat-suppression shows mild enhancement in the solid component (arrowheads) within mass (arrows).

DISCUSSION

Ovarian CAF is a composite neoplasm that contains both benign epithelium and stroma. Adenofibromas of the ovary are tumors with neoplastic glandular elements and a predominant, benign stroma. When large cystic spaces are present within the glandular elements, then the tumor is designated as CAF. CAF belongs to the surface epithelial tumors, and these contain various amounts of fibrous stroma in all the subtypes. The subtypes of this tumor are the benign, proliferating and malignant tumors that are categorized by the cytologic features of the glandular

component (1, 2). Although the real incidence of CAF is uncertain, some investigators believe that it is more common than has been reported (4).

The MR imaging findings of CAF have not been widely investigated (5–7). The previously described MR findings (a multilocular cystic mass with a T2-dark-signal-intensity solid component containing small cystic locules) were observed in 43% of our cases, but these were not the predominant findings of CAF in our study. Our study revealed that multilocular ovarian cysts with diffusely or partially thickened, dark-signal-intensity walls on the T2-weighted images were the other findings that occurred in our study at with same frequency as the previous findings.

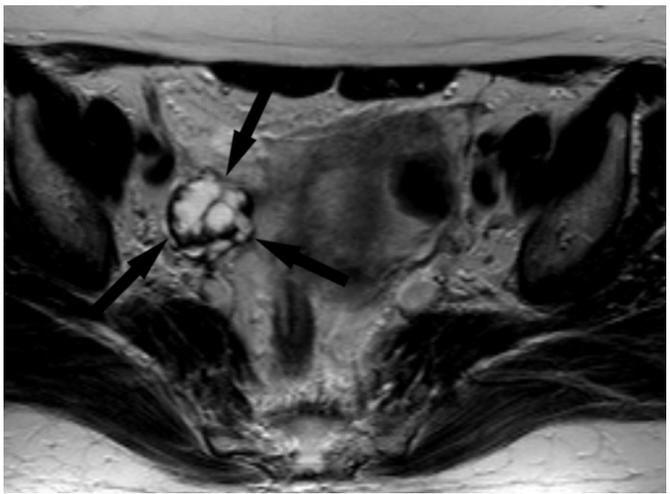
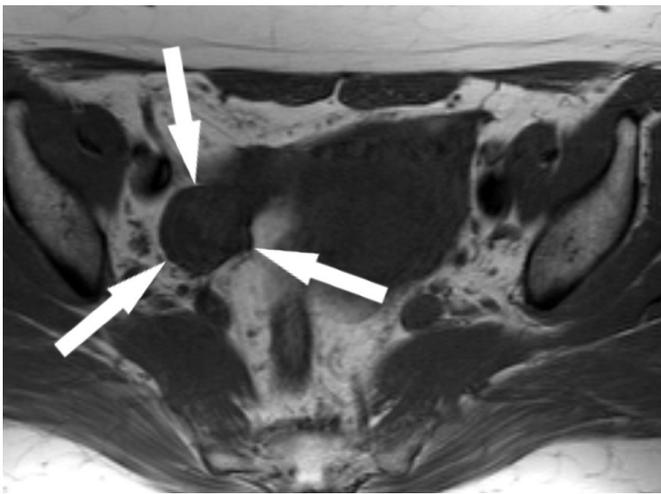


Fig. 3. A 58-year-old woman with a serous cystadenofibroma. The T1- (A) and T2-weighted (B) MR images show a multilocular cystic mass in the right adnexal region (arrows). The wall of the mass was irregularly and partially thickened, and it appeared as dark signal intensity on this T2-weighted image.

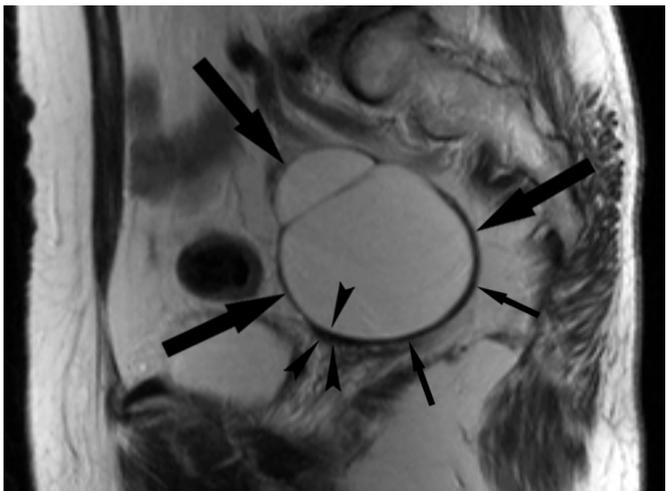
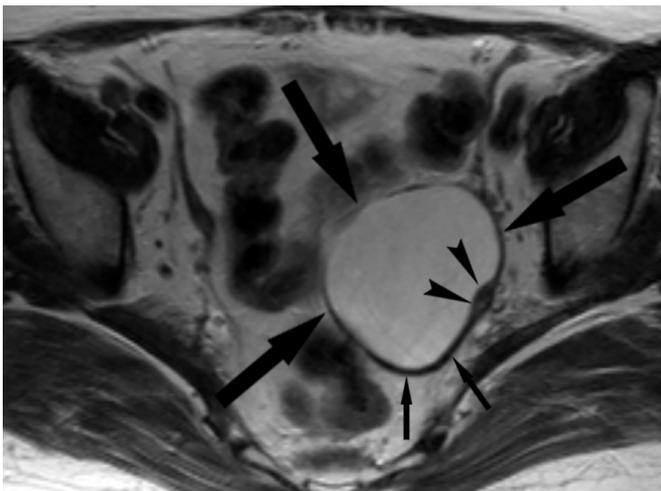


Fig. 4. A 58-year-old woman with a serous cystadenofibroma. The T2-weighted MR images in the axial (A) and sagittal (B) planes show a bilocular cystic mass (arrows) surrounded by a partly-thickened wall of dark-signal-intensity (small arrows) in the left ovary. Note the presence of focal nodular thickening (arrowheads).

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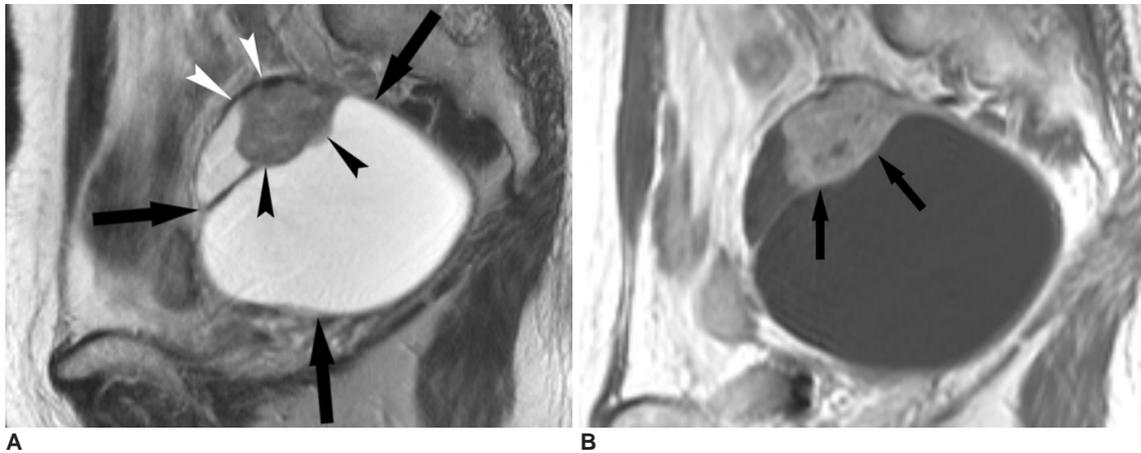


Fig. 5. A 62-year-old woman with an endometrioid cystadenocarcinofibroma.

A. The T2-weighted MR image in the sagittal plane shows a multilocular cystic mass (arrows) with a solid component (black arrowheads) in the left ovary. Partial thickening with dark-signal-intensity was noted in the superior part of the wall (white arrowheads). The solid component shows relatively higher signal intensity compared with the benign counterpart in Figure 1 and 2.

B. The contrast-enhanced T1-weighted MR image with fat-suppression shows strong enhancement in the mass (arrows).

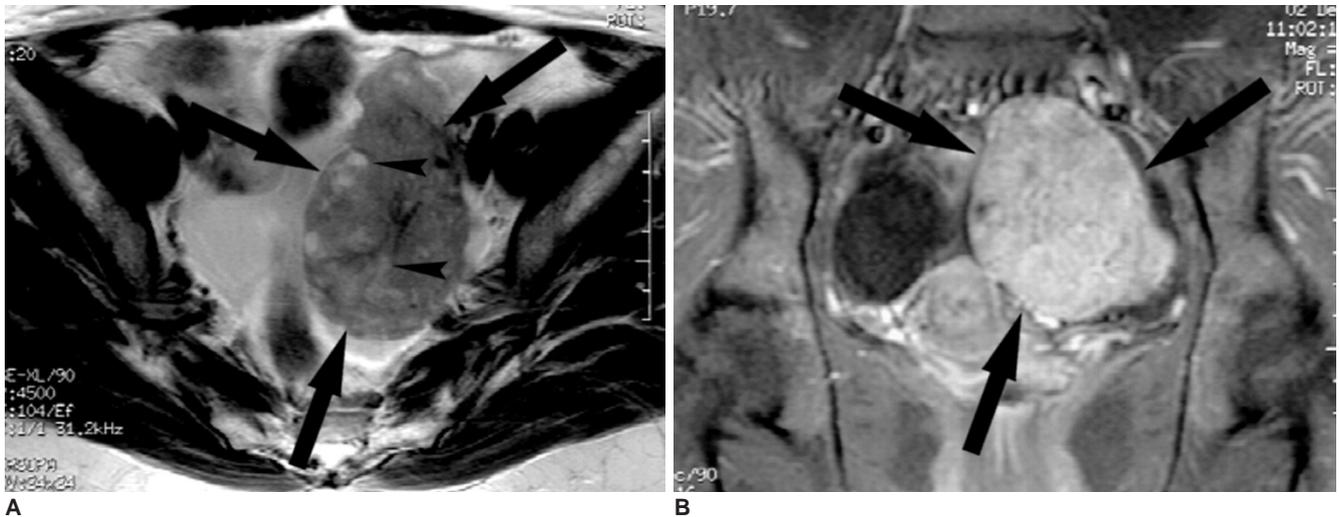


Fig. 6. A 43-year-old woman with serous cystadenocarcinofibroma.

A. The T2-weighted MR image shows a mainly solid mass (arrows) in the left ovary. The mass contained multiple, small cystic locules (arrowheads) and it was of intermediate signal intensity.

B. The contrast-enhanced T1-weighted MR image shows strong enhancement in the solid component (arrows).

This dark-signal-intensity thickening may represent a dense fibrous component within the wall, although no precise correlation with the pathologic finding was made.

Other ovarian tumors may demonstrate dark-signal-intensity rims on the T2-weighted images. Endometriotic cysts may contain a peripheral rim of low-signal-intensity, and this represents hemosiderin or a fibrous capsule (8). The ovarian masses with fibrous components, including fibroma, fibrothecoma and Brenner tumor, are benign tumors with a predominantly solid component, and they demonstrate low signal intensity on the T2-weighted images (9–12). Metastases with a high fibrous component (particularly from the gastrointestinal tract) often show

hypointense areas on the T2-weighted images with strong enhancement (13). Struma ovarii may have solid components, multilocular cystic components and multilobulated surfaces. Cystic locules contain viscid gelatinous materials and they show as low signal intensity on the T2-weighted images with no contrast enhancement. A characteristic clinical setting (associated hyperthyroidism) and preoperative scintigraphy may be useful for differentiating struma ovarii from the other ovarian tumors (14).

In general, the likelihood of malignancy increases with an increasing solid tissue portion and thicker septa. Although contrast enhancement usually increases the accuracy of differentiating benign from malignant lesions,

its usefulness may be limited for some types of tumors (15). In our study, the malignant tumors (CACF) had a greater sized solid portion with strong enhancement and higher signal intensity compared with the benign tumors (CAF).

Our study has several limitations. First, the small numbers of cases might not accurately reflect the full imaging spectrum of these tumors. Second, we included only the patients who had undergone MR examinations, which could result in a selection bias. Finally, precise pathologic correlation with the imaging findings was not performed.

In conclusion, diffuse or partial thickening of the cystic wall with a T2-dark-signal-intensity in multilocular cystic masses is another suggestive MR finding of ovarian CAF, as well as the previously reported characteristic findings. A prominent solid component with a higher T2-signal intensity and strong enhancement may represent its malignant counterpart.

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