



Solidified mucinous tumor of the ovary presenting characteristic MRI finding

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ABSTRACT

Mucinous tumors are a common ovarian cystic tumor, having a characteristic finding on MR imaging, the so-called stained glass appearance. We report a rare case of a solidified mucinous tumor of the ovary, which showed unique findings on MR images. The tumor demonstrated hypointensity on T2-weighted images, not stained glass appearance, mimicking ovarian fibrous tumor such as thecoma-fibroma. Histopathological examination confirmed solidified contents of the tumor with numerous septa and diagnosed mucinous borderline tumor/atypical proliferative tumor.

1. Introduction

Mucinous tumors (MTs) are one of the common epithelial neoplasms of the ovary, having potential malignancy. Most of MTs show a multi-cystic appearance grossly filled with mucus, and on magnetic resonance (MR) images, show hypointensity and hyperintensity on T1 and T2-weighted images, respectively. Especially on T2-weighted images, each cystic portion may show different signal intensities, resulting in a so-called stained glass appearance, well known as a characteristic imaging finding of MTs. We herein report a rare case of mucinous tumor of the ovary composed of firm gelatinous texture wholly, which was hypointense on T2-weighted images, mimicking ovarian fibrous tumor such as thecoma-fibroma group of ovarian stromal tumors.

2. Case report

A 46-year-old Asian female was referred to our hospital for the examination of a pelvic mass detected by ultrasonography on a routine medical check-up. Physical examination revealed slight tenderness in the right lower abdomen. Blood test and tumor markers including alpha-fetoprotein, carcinoembryonic antigen, β -human chorionic gonadotropin, and carbohydrate antigen 125 were normal, and various hormonal tests including estradiol, progesterone, and testosterone were also normal.

Transvaginal ultrasonography revealed a well-circumscribed and globular low echoic mass with punctate rod-shaped high echoic area (Fig. 1). The maximum diameter of the tumor was 7 cm. On MRI examinations, the tumor demonstrated heterogeneous slight hyperintensity on T1-weighted images and extremely hypointensity on T2-weighted ones (Fig. 2a, b). A reticulated structure was observed within the mass, showing relative hyperintensity on T2-weighted images. Although contrast-enhanced fat-saturated T1-weighted images exhibited slight enhancement at reticulated structures, most of the tumor did not show any enhancement (Fig. 2c). A unilocular well-demarcated cyst was observed in the mass. On diffusion-weighted images (DWI), the tumor showed slightly high signal intensity (Fig. 2d). There was no fat component in the tumor. ¹⁸F-FDG-PET did not show definite uptake in the tumor. On unenhanced CT, the tumor showed heterogeneous hyperattenuated (Fig. 3). The tumor was suspected to belong to sex cord-stromal tumors including the fibroma and thecoma, stroma ovarii, or Brenner tumor of right ovary based on the characteristic hypointensity on T2-weighted images.

Because the tumor was large, surgical resection was performed. Macroscopically, the ovarian tumor was round and well-encapsulated, and the cut surface of the tumor was composed of multiple yellowish firm gelatinous texture deposition separated by fibrous septa (Figs. 4 and 5a). Microscopically, the gelatinous component stained positive for Alcian Blue and periodic acid-Schiff-diastase staining, suggesting the

Abbreviations: MTs, mucinous tumors

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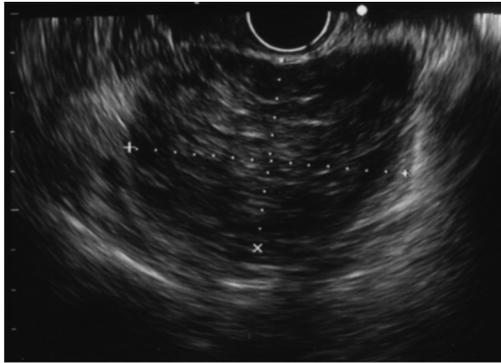


Fig. 1. Ultrasonography (US). US showed a well-circumscribed hypoechoic mass, with spotty hyperechoic lesions, 70 mm in diameter.



Fig. 3. Unenhanced CT. On unenhanced CT, the tumor demonstrated heterogeneous hyper-attenuated.

presence of degenerated mucin. No septal thickenings or mural nodules were noted. On the septal structure, the septal lined cells were simple thin epithelium composed of low papillary column cells with cytoplasmic clear mucin (Fig. 5b). Although there were no stromal invasions in the septum or capsule, papillary cell proliferation, pseudostriated epithelium pattern and nuclear enlargement were observed, and led to the pathological diagnosis of mucinous borderline tumor/atypical proliferative tumor.

3. Discussion

MTs of the ovary are the second most common ovarian neoplasm

composed of gastrointestinal-type epithelial cells, accounting for approximately 20%. MTs of the ovary are classified as cystadenoma, borderline tumor/atypical proliferative tumor, and carcinoma. Borderline tumor and malignant tumors comprise 10% and 5% of all MTs, respectively [1]. The classification is determined pathologically on the basis of the cytological, structural findings and stromal invasion, sometimes presenting a diagnostic dilemma [2].

On MRI, primary mucinous cystic tumors appear as huge multicystic masses and the loculi of the tumor often show various signal intensities on both T1- and T2-weighted images, resulting in the so-called stained glass appearance reflecting the presence of gelatinous material or fluid of various viscosities [3]. Although this stained glass

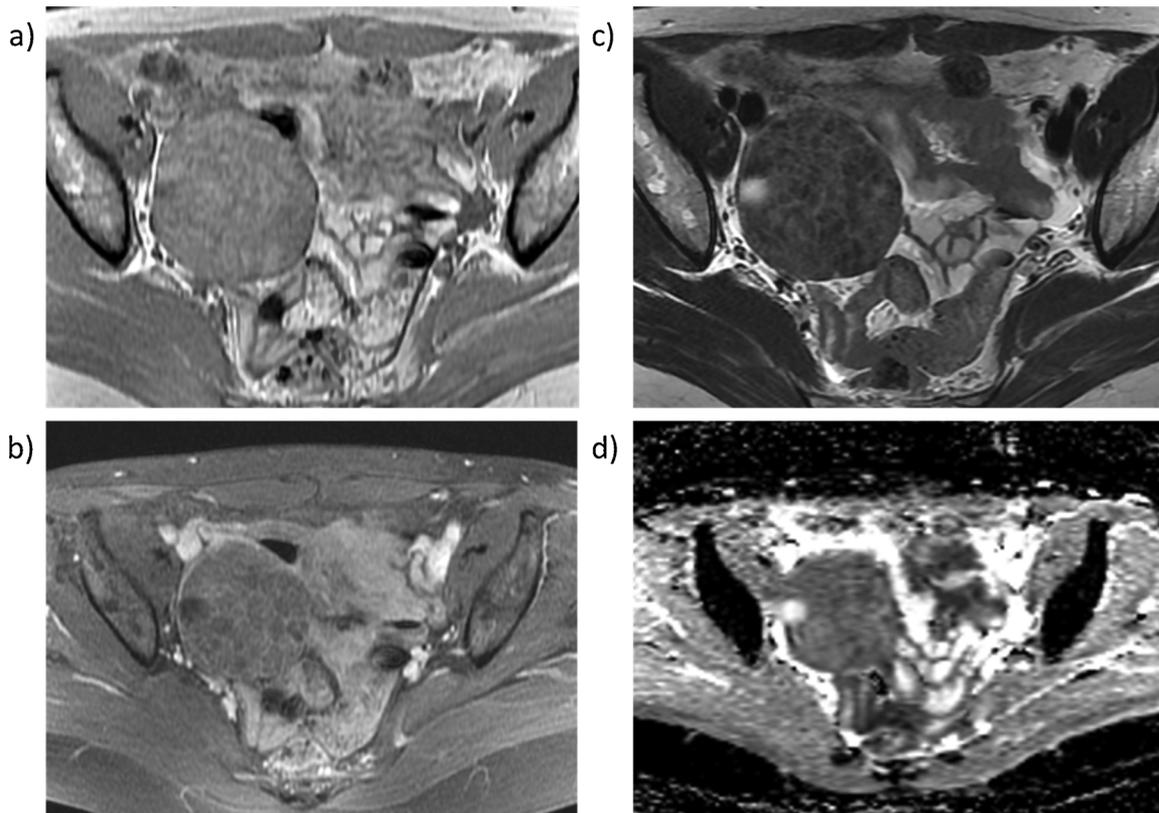


Fig. 2. Magnetic resonance (MR) imaging.
 a) The mass showed heterogeneous hyperintensity on T1-weighted MR images (repetition time [TR]/effective echo time [TE], 300/2.4 ms).
 b) T2-weighted images demonstrated hypointense mass with hyperintense reticular structures (TR/TE, 4267/91 ms). A unilocular cyst was also present in the mass.
 c) Contrast-enhanced MR images with fat-saturation showed slight reticular enhancement (TR/TE, 4.2/2.0 ms).
 d) Apparent diffusion coefficient value of the tumor was $1.38 \times 10^{-3} \text{ mm}^2/\text{s}$ (TR/TE, 4800/64 ms, b-value = 800 s/mm²).

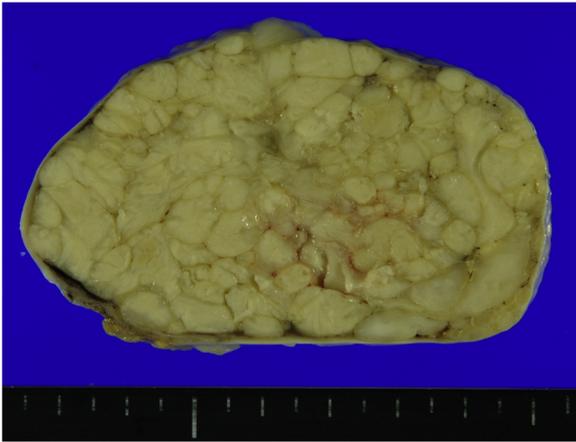


Fig. 4. Photograph of cut surface of ovarian tumor. The cut surface of the mass showed multiple whitish firm gelatinous texture deposition with septa.

appearance is also seen in various kinds of tumor such as metastatic ovarian tumor or stroma ovarii, MTs is the most common lesion demonstrating this appearance. In general, the malignant tumors contain a solid component in the tumor, whereas ovarian mucinous carcinoma contains almost no macroscopic solid component. When determining the malignancy of MTs, the number of loculi and the maximum diameter of the tumor are reported to be useful diagnostic clues [4].

This case highlighted an important radiological pathological issue. MTs can present as a black tumor on T2-weighted MR images and can demonstrate solidified appearance macroscopically.

Initially, the ovarian tumor of this case was radiologically diagnosed as fibroma or thecoma, because the tumor present as extremely hypointense on T2-weighted MR images. Surgical specimen also revealed firm tumor mimicking solid not cystic tumor, however, the lesion was finally diagnosed with solidified mucinous tumor pathologically. Ovarian tumors presenting hypointensity on T2-weighted images are

limited and this finding is helpful in the differential diagnosis from various other ovarian tumors. Hypointensity on T2-weighted images reflects the following materials: fibrous stroma, high cell density, hemosiderin, and mucinous liquid. The thecoma-fibroma group of ovarian stromal tumors is the most common ovarian tumor exhibiting hypointensity on T2-weighted images due to intratumoral rich fibrous stroma; moreover, Brenner tumor also appears hypointense for the same reason. Metastatic ovarian tumor can show heterogeneous intensities on T2-weighted images, so-called stained glass appearance, resembling MTs [5]. In addition to them, subserosal myoma and gastrointestinal tumor are also important extraovarian tumors in the differential diagnosis.

Although ovarian MTs in part contains high viscous liquid and appears partially hypointense on T2-weighted images, no previous case report has demonstrated firm gelatinous MTs showing uniform hypointensity on T2-weighted images. The main reason for the hypointensity on T2-weighted images in this case is attributed to the cyst contents. Pathologically, the contents of cysts in the present case were composed mainly of extra firm gelatinous material like wax, and this content resulted in decreasing intensity on T2-weighted images.

Retrospectively, the reticulated structures in the tumor might be useful for the radiological diagnosis of MTs. The present case showed hyperintense reticular structures on T2-weighted images and slight contrast enhancement. This finding reflected the pathological septal structure. These findings represent the differential point between MTs and other fibrous tumors regarding black tumor on T2-weighted images. In the present case, the tumor was pathologically diagnosed as mucinous borderline tumor/atypical proliferative tumor, however, it was impossible to detect the findings of borderline malignancy on MRI images and thought to be difficult to diagnose as borderline malignancy preoperatively.

In conclusion, we reported a case of ovarian solidified mucinous tumor containing a firm gelatinous material showing black tumor on T2-weighted images. It is important to consider the possibility of MTs when finding reticular structures in a mass appearing in its entirety on T2-weighted image.

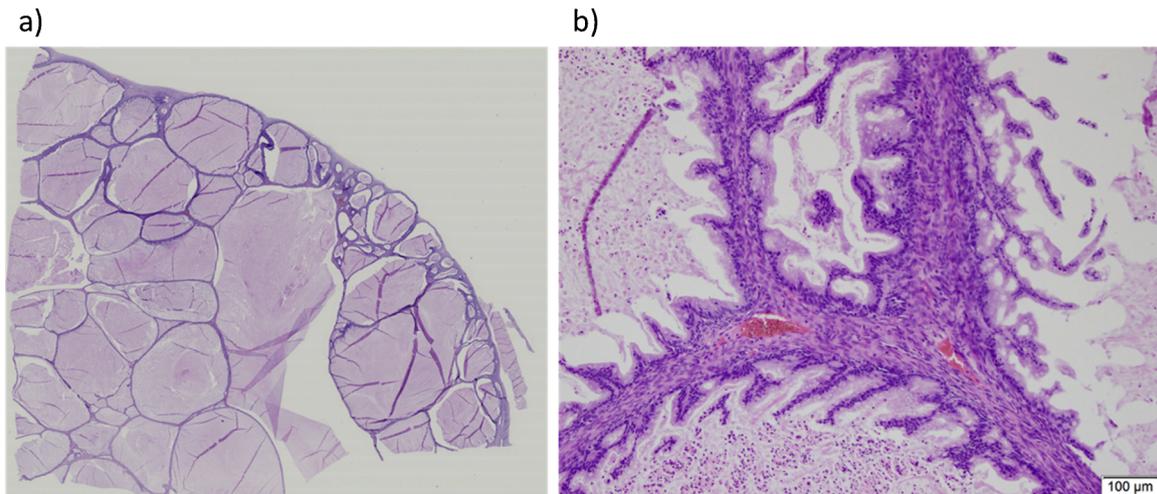


Fig. 5. Histopathological finding of surgical specimen (Macrograph and magnified image).

a) On Macrograph of resected specimen, the gelatinous portion consisted of degenerated mucin.

b) On the septal structure, papillary cell proliferation, pseudostratified epithelium pattern and nuclear enlargement were observed in some areas.

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Conflict of interest

None of the authors have any relevant conflict of interest or industry support related to this report.

This study does not require institutional review board approval. Informed consent was obtained for the case report to be published.

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