We report a rare case of ovarian leiomyoma with extensive edema in a 55-year-old woman. Magnetic resonance (MR) imaging revealed an ovarian mass with distinct portions of predominantly low intensity and predominantly high intensity on T2-weighted image. The portion with low signal showed weak enhancement on contrast study, and the portion with high intensity suggested extensive edema of fibrous stroma. Furthermore, the mass showed low signal intensity similar to that of the myometrium on diffusion-weighted image and yielded high values on apparent diffusion coefficient (ADC) map image. Extensive edema of ovarian leiomyoma shows unusual MR imaging findings that require careful interpretation.

Keywords: edema, leiomyoma, MRI, ovary

Introduction

Ovarian leiomyoma is a rare benign tumor that accounts for about one percent of benign ovarian neoplasms and occurs mainly in women aged 20 to 65 years.1-3 The tumors usually measure less than 3 cm and are asymptomatic, but abdominal pain or hydronephrosis may accompany a large ovarian leiomyoma.4-6

Descriptions of several cases of ovarian leiomyoma with the magnetic resonance (MR) imaging findings have been reported, but few reports describe the tumor as a well circumscribed mass of low signal intensity on both T1- and T2-weighted MR images.7-10

We present a case of ovarian leiomyoma with unusual MR imaging findings that show heterogeneous high signal intensity on T2-weighted image as a result of extensive edema. We believe this is the first report in the MR literature on the appearance of ovarian leiomyoma with extensive edema that includes diffusion-weighted image.

Case Report

A 55-year-old woman was referred to our hospital from a local clinic for lower abdominal pain of 3 months’ duration and sonographic detection of a mass in the lower abdomen. The patient had a history of total hysterectomy with bilateral ovary-conserving surgery due to intramural myoma. Pelvic examination revealed a large well defined mass of soft tissue at the right side of the pelvic space. Serological tumor markers, such as carbohydrate antigen 125, carcinoembryonic antigen, and alphafetoprotein, were within normal limits.

Contrast-enhanced computed tomographic (CT) scan revealed a large well defined mass of approximately 10×7 cm in the right adnexal area with slight enhancement in the cystic component (Fig. 1). MR images obtained to characterize the lesion further revealed a cystic component of approximately 10×7-cm diameter with well defined shape in the right adnexal region (Fig. 2a–c). On axial T1-weighted image, the mass showed homogeneous signal intensity that was slightly low compared to muscle (Fig. 2a). On axial T2-weighted image, the mass showed heterogeneous high and low signal (Fig. 2b). Signal intensity of the mass was mainly
Fig. 1. Contrast-enhanced computed tomographic image shows a mass lesion of approximately 10×7-cm diameter and well defined shape in the right adnexal region. The tumor shows partial weak enhancement in the right side.

low in the ventral portion (arrow) and high in the dorsal portion (arrowhead). On axial fat-saturated T1-weighted image with gadolinium enhancement, the mass showed heterogeneous weak high signal intensity (Fig. 2c). The areas of low signal intensity of the tumor on T2-weighted image revealed structures with weak high signal intensity (Fig. 2c). Diffusion-weighted image (repetition time [TR]/echo time [TE], 5200/67 ms; b value, 1000 s/mm²) showed intermediate signal intensity (Fig. 2d), and apparent diffusion coefficient (ADC) map image yielded high ADC values (1.89×10⁻³ mm²/s) (Fig. 2e). The enhanced solid portion did not allow us to rule out malignant carcinoma of the ovary or fallopian tube at preliminary preoperative diagnosis, so we performed right adnexectomy.

The internal cut surface of the right ovarian tumor showed varied edematous change of the stroma; some parts showed a solid portion and region of edema (Fig. 3a). Microscopic examination demonstrated the solid portion of the right ovarian tumor to be rich in epithelial elements (Fig. 3b) and composed of smooth muscle cells; the edematous region of the right ovarian tumor comprised massive edematous stroma and a few smooth muscle cells (Fig. 3c). The tumor showed positive response to immunochemical staining with antibodies to vimentin, desmin, and smooth muscle actin and was diagnosed as ovarian leiomyoma.

Discussion

Primary leiomyoma of the ovary is very rare and benign.¹-³ Most tumors are asymptomatic and found incidentally, but patients with some larger tumors, such as ours, may complain of mild lower abdominal pain.⁴-⁶ Primary ovarian leiomyoma also frequently coexists with uterine leiomyoma, and our patient had a history of total hysterectomy for intramural leiomyoma.

MR imaging findings of primary ovarian leiomyoma typically show a well circumscribed mass with low signal intensity that is sharply demarcated from the uterus on both T1- and T2-weighted images.⁷-¹⁰ Histopathological findings of ovarian leiomyoma are identical to those of leiomyoma in other locations, such as the uterus. Therefore, the low signal intensity of ovarian leiomyomas on both T1- and T2-weighted images has been attributed to the smooth muscle components generally demonstrated by leiomyomas.⁷-¹⁰

Our case showed high signal intensity on T2-weighted image due to ovarian edema. In uterine leiomyoma, edema is a common histopathologic finding (50% of adult leiomyomas) and can appear for multiple reasons, such as torsion.¹¹ Our patient had no ovarian torsion. Although the cause of edematous change in our case is unknown, MR findings of larger leiomyomas reflect varied histopathological change, such as edema, degeneration, necrosis, hemorrhage, and calcification. Although Kohno and colleagues reported degenerative large ovarian leiomyoma, their T2-weighted images showed multiple cystic changes with band-like signal.⁹

Macroscopic examination of the tumor demonstrated 2 distinct parts—a solid portion and a region of edema (Fig. 2a). Smooth muscle cells of the ovarian mass showed low signal intensity because of the fibrous MR signal, and edematous stroma showed high signal intensity on T2-weighted image. The many smooth muscle cells of the solid portion showed low signal on T2-weighted image and weak enhancement on contrast study. In contrast, decreased interstitial space from extensive edema and fluid accumulation in the ovary showed low signal on contrast study (Fig. 1b, c). Thus, our unusual MR imaging findings of various signal intensities on T2-weighted image could be explained by the extent of edema in the ovarian leiomyoma.

Although dynamic contrast-enhanced MR study is reported useful for identifying ovarian leiomyoma as increased signal intensity in the early phase of contrast study,⁹ we did not perform such study. The tumor in our case showed intermediate signal
Fig. 2. (a) On axial T₁-weighted image (repetition time/echo time [TR/TE], 630/12 ms), signal intensity of the mass was slightly low compared to muscle. (b) On axial T₂-weighted image (TR/TE, 4400/103 ms), the mass showed heterogeneous high and low signal. Signal intensity of the mass was mainly low in the ventral portion (arrow) and high in the dorsal portion (arrowhead). (c) On axial fat-saturated T₁-weighted image with gadolinium (Gd) administration (TR/TE, 630/12 ms), the mass showed heterogeneous weak high signal intensity. The areas of low signal intensity of the tumor on T₂-weighted images revealed structures with weak high signal intensity. (d) On axial diffusion-weighted image (TR/TE = 5200/67 ms, b value = 1000 s/mm²), the mass showed intermediate signal intensity (arrows). (e) On axial apparent diffusion coefficient (ADC) image, the mass showed relatively high ADC value (ADC value of region of interest = 1.89 × 10⁻³ mm²/s).
Fig. 3. Pathologic findings. (a) The cut surfaces of the gross specimen of the right ovarian tumor show solid portion (arrowheads) and edematous region (arrows). (b) On microscopic examination, the solid portion of the right ovarian tumor is rich in epithelial elements and composed of smooth muscle cells (hematoxylin and eosin [H&E] stain, ×10). (c) On microscopic examination, the edematous region of the right ovarian tumor is not rich in epithelial elements. Tumor composition is primarily massive edematous stroma with a few smooth muscle cells (arrows) (H&E stain, ×10).

intensity on diffusion-weighted image and high value on ADC map. Malignant tumors of the ovary and fallopian tube usually show high signal intensity on diffusion-weighted image as a result of high cellular density and structural distortion. This tumor might not have demonstrated high signal intensity because the pathology showed little cellular content, and edematous change was prominent. The diffusion-weighted images could reflect the histological conditions.

MR imaging findings of our case showed mixed high and low signal intensity on $T_2$-weighted image and weak and heterogeneous enhancement on fat-suppressed, gadolinium-enhanced $T_1$-weighted image (Fig. 2b, c). Differential diagnosis included fibroma or fibrothecoma with edematous change and malignant tumor of the ovary or fallopian tube. Especially, these MR signal patterns particularly mimicked those of fibroma or fibrothecoma with edematous change. Differentiation of ovarian fibroma and leiomyoma is difficult because histological evaluation requires assessment of immunohistological activity of muscle markers, such as desmin and smooth-muscle actin. We did not consider ovarian leiomyoma in our preoperative differential diagnosis because this tumor is rare and its MR signal pattern is unusual.

We have presented a rare case of benign ovarian leiomyoma in a 55-year-old woman that demonstrated unusual MR imaging findings that mimicked those of a malignant ovarian tumor, fallopian tube carcinoma, or fibroma/fibrothecoma and that resulted from extensive edema. Our study demonstrates the capacity of MR imaging to distinguish solid and edematous portions of an ovarian leiomyoma with extensive edema.

References

Unusual MR Findings in Ovarian Leiomyoma