Sponge-like masses in the female pelvis: Functioning ovarian tumors and other pathologies

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Learning objectives

To review the MR-pathologic correlation of various gynecologic pathologies manifesting sponge-like appearances. To demonstrate diagnostic clinical and MR features of various sponge-like masses in the female pelvis.

Background

Sponge-like mass (SLM) is characteristic morphologic feature of various gynecologic pathologies which is well visualized on T2-weighted images and contrast-enhanced T1-weighted images.

SLM is often observed in functioning ovarian tumors, however, some ovarian surface epithelial-stromal tumors may also appear as SLM. Some benign and malignant uterine cervical pathologies, uterine cavitary lesions, benign gynecologic tumors with multicystic degeneration, and peritoneal lymphangiomas may also appear as SLM.

In this exhibit we demonstrate various SLM and describe diagnostic clinical and MR features of the pathologies.

Imaging findings OR Procedure details

-Ovary (Fig. 1 on page 6)

[Functioning ovarian tumors]

"Sponge"-like appearance is well known as macroscopic feature of Granulosa cell tumor. Other functioning ovarian tumors such as Sertoli stromal cell tumor, and Carcinoid tumor, may also appear as SLM due to dilated vascular spaces. Functioning ovarian tumor usually has a hypervascular nature, and may show intense contrast-enhancement on the early phase of dynamic contrast-enhanced CT/MRI. Hormone-related symptoms and high serum hormone levels are helpful for the diagnosis.

- Granulosa cell tumor (Fig. 2 on page 6) (Fig. 3 on page 7) is the most common estrogen-producing functioning ovarian tumor, and may contain variable amount of cystic components with hemorrhage. Typically granulosa cell tumor, however not always, may appear as SLM. About two-thirds of granulosa cell tumor present in postmenopausal...
women. Enlargement of the uterus with endometrial thickening in postmenopausal women with abnormal genital bleeding is suggestive for estrogenic functioning ovarian tumors such as granulosa cell tumor and thecoma.

- **Sertoli stromal cell tumor** (Fig. 4 on page 8) is a rare functioning ovarian tumor, which affects young women (30 years of age or younger). Sertoli-stromal cell tumor may show various imaging manifestations from solid to totally cystic, and may occasionally appear as SLM. Virilization is suggestive for Sertoli-stromal cell tumor with androgenic effect.

- **Carcinoid** (Fig. 5 on page 9) is a rare functioning ovarian tumor, which affects postmenopausal or perimenopausal women. Carcinoid may appear as non-specific solid mass or SLM, but may be often combined with mature cystic teratoma or mucinous tumor. Carcinoid may be associated with the typical carcinoid syndrome with flushing and diarrhea, or may produce peptide YY which inhibits intestinal mobility and causes chronic constipation.

**[Surface epithelial-stromal ovarian tumors]**

In ovarian surface epithelial-stromal tumors, aggregation of numerous tiny loculi in **borderline mucinous tumor**, reticular fibrous septa in **clear cell tumors**, tiny glandular cysts within fibrous stroma in **cystadenofibroma** may cause SLM.

- **Borderline mucinous tumor** (Fig. 6 on page 10)

Mucinous tumor usually appears as a multilocular cystic mass containing thick to watery mucinous fluid. Mucinous tumor may partially or totally appear as SLM, which consisted of fine numerous loculi. These tumors showed relatively low signal intensity on T2-weighted images mimicking fibrous tumors due to thick mucinous materials filled with the loculi, and reticular intra-tumoral structures observed on T2-weighted images and on post-contrast T1-weighted images reflecting fine honeycombing gross appearance formed by the aggregation of numerous tiny loculi may be helpful to differentiate from benign fibrous tumors, which may show amorphous appearance with no internal structure or with random cystic degenerations. High ADC value in the tumor on diffusion-weighted imaging (DWI) may be suggestive for its microcystic nature, and may be another clue for the diagnosis of mucinous tumor.

- **Clear cell tumors** (Fig. 7 on page 11)

Most clear cell tumors are malignant as clear cell adenocarcinoma or adenocarcinofibroma. Typical clear cell adenocarcinoma may appear as unilocular
cystic mass with polypoid mural nodules. Rarely clear cell tumors, especially clear cell adenocarcinofibroma, may appear as SLM. Histologic section shows tubulocystic pattern with prominent hobnail cells. The lumens of the tubules and numerous tiny cystic spaces formed by the delicate fibrous trabeculae supporting the tumor cells are filled with coagulated necrotic tissues and mucinous materials. On post-contrast images, reticular contrast-enhancement pattern reflecting the meshworks of delicate fibrous trabeculae may appear as SLM, and may be helpful to differentiate from benign fibrous tumors.

- **Cystadenofibroma** *(Fig. 8 on page 12)*

The solid portion of cystadenofibroma is composed of dense fibrous tissue in which glandular structures are present. On US/CT, cystadenofibroma may appear as a non-specific solid and cystic adnexal mass mimicking malignancy. On T2-weighted images, cystadenofibroma may show characteristic "black sponge-like appearance": a fibrous low intense mass containing multiple high intense tiny cysts reflecting glandular components.

[Various tumors with multicystic degeneration] *(Fig. 9 on page 13)*

In various benign and malignant ovarian tumors, SLM may be formed by multicystic degeneration.

- **Uterus** *(Fig. 10 on page 14)*

[Uterine cervical lesions]

Benign or malignant glandular dilatation within uterine cervical stroma may cause SLM in *Lobular endocervical granular hyperplasia (LEGH)*, *Adenoma malignum*, and *Deep nabothian cysts*. Tiny glandular cysts within *Cervical adenocarcinoma* may also appear as SLM. The presence of solid tumoral components and prominent watery discharge may suggest rather malignant lesion in the uterine cervix *(Fig. 12 on page 16) (Fig. 14 on page 18) (Fig. 15 on page 19).*

- **Lobular endocervical glandular hyperplasia (LEGH)** *(Fig. 11 on page 15) (Fig. 12 on page 16)*

Lobular endocervical glandular hyperplasia (LEGH) is a benign hyperplastic lesion with cystic dilatation of the uterine cervical glands. LEGH commonly affects middle-aged women and is usually located at upper part of the endocervical region. LEGH may be asymptomatic, however, may occasionally cause watery discharge like adenoma malignum. LEGH appears as SLM mimicking adenoma malignum, however, because the solid portion of SLM is enlarged cervical stroma and shows low signal intensity on T2-weighted images and on DWI.
- **Deep nabothian cysts** *(Fig. 13 on page 17)*

Nabothian cysts (retention cyst of the uterine cervix) are cystic dilatation of the endocervical glands, which may be formed during the healing process of chronic cervicitis. Usually nabothian cysts are located superficially in the uterine cervix, however, occasionally extend deep into the cervical stroma as deep nabothian cysts. Multiple deep nabothian cysts may enlarge the uterine cervix and cause SLM mimicking LEGH or adenoma malignum. Like LEGH, the solid portion of SLM is enlarged cervical stroma and shows low signal intensity on T2-weighted images and on DWI.

- **Adenoma malignum (Minimal deviation adenocarcinoma)** *(Fig. 14 on page 18)*

Adenoma malignum (Minimal deviation adenocarcinoma) is a rare variant of cervical well differentiated adenocarcinoma. Prominent watery discharge is suggestive symptom. Adenoma malignum commonly affects middle-aged women and may often invade beyond the endocervical region and involve the portio. Adenoma malignum appears as SLM, and the solid portion of SLM shows high signal intensity on DWI, and intensely contrast-enhanced on post-contrast images.

- **Cervical adenocarcinoma** *(Fig. 15 on page 19)*

Cervical adenocarcinoma may also appear as SLM. Rather well differentiated adenocarcinoma tends to contain glandular cystic areas within the solid tumoral component. The solid portion of SLM, which shows high signal intensity on DWI, and intensely contrast-enhanced on post-contrast images, tends to be more massive than that of adenoma malignum.

**[Uterine endometrial cavitary lesions]**

*Endometrial hyperplasia* *(Fig. 16 on page 20)* is abnormal proliferation of endometrial stroma and glands, and usually appears as endometrial thickening. Endometrial hyperplasia occasionally appears as SLM due to cystic glandular dilatation. Tamoxifen-associated endometrial hyperplasia tends to contain more cystic areas, and may appear as SLM.

*Hydatidiform mole* *(Fig. 17 on page 21)*, which is the most common form of gestational trophoblastic disease, distends and fills the endometrial cavity. Grossly swollen villi from trophoblastic hyperplasia may appear as numerous small cystic areas, and cause SLM in the endometrial cavity. Blood tests shows very high level of human chorionic gonadotropin (hCG).

**[Uterine myometrial lesions]**
SLM may be formed by multicystic degeneration of benign leiomyoma (Fig. 18 on page 22), which may locate at intra-myometrial or subserosal region. Associated hemorrhagic change is rarely observed and may suggest rather malignant lesion.

-Others

[Peritoneal lesions]

Lymphangioma (Fig. 19 on page 23) appears as SLM in the peritoneal cavity. Dilated lymph vessels containing chylous to hemorrhagic lymph fluid.

Images for this section:

**Sponge-like masses: Ovary**

- Dilataed vascular space *in Functioning tumors*
- Tiny granular cysts within fibrous stroma *in cystadenofibroma*
- Multicystic degeneration *in various tumors*
- Aggregation of numerous tiny loculi *in Mucinous tumors*
- Reticular fibrous septa *in clear cell tumors*

Fig. 1: Figure 1
Granulosa cell tumor
Numerous cystic components with hemorrhage

Fig. 2

CE-fsT1WI cor

Fig. 2: Figure 2

T2WI sag  T2WI  DWI

Cellular portion shows high intensity on DWI

Typical Granulosa cell tumor may appear as Sponge-like mass
Granulosa cell tumor may contain sponge-like areas in part.

Numerous cystic components with hemorrhage.
**Sertoli-stromal tumor**

**Commonly solid and cystic mass**

Occasionally solid portion appears as sponge-like mass

Virilization is suggestive for Sertoli-stromal cell tumor with androgenic effect.

**Fig. 4:** Figure 4
**Fig. 5:** Figure 5

Carcinoid

**Hormonal symptoms:**
1. Carcinoid syndrome with flushing and diarrhea
2. Chronic constipation due to Peptide YY

Occasionally solid portion appears as sponge-like mass
**Borderline mucinous tumors**

**Fig. 6**

**T2WI**

**CE-fsT1WI**

Hypointense mass with slight reticular patterns

Reticular contrast-enhancement reflecting intra-tumoral meshwork structures

No signal increase on DWI with high ADC may suggestive for its microcystic nature

Thick mucinous contents within the numerous tiny cystic spaces formed by the meshes of papillary growing tumor cells

**Fig. 6:** Figure 6
Fig. 7: Figure 7
Cystadenofibroma

"Black sponge-like appearance"

High intense tiny cysts scattered within Low intense mass on T2WI as "Black Sponge"-like appearance

Fibrous stroma: T2-Low

Dilated Glands

Dense fibrous stroma

Fig. 8: Figure 8
Multicystic degeneration may occur in various benign and malignant ovarian lesions.
Sponge-like masses: Uterus

Cervical lesion with glandular dilatation
in Epithelial lesions

Myometrial lesion with multicystic degeneration
in Leiomyoma

Endometrial cavitary lesions
in Mole / Endometrial hyperplasia

Fig. 10: Figure 10
Fig. 11: Figure 11
Fig. 12: Figure 12
Fig. 13: Figure 13
Adenoma Malignum
(Minimal Deviation Adenocarcinoma)

Often invade beyond the endocervical region and involve the portio

Fig. 14: Figure 14
Cervical adenocarcinoma

Small glands are scattered within the solid mass: *Sponge-like mass*
Solid portion is contrast-enhanced, and shows high intensity on DWI

**Fig. 15:** Figure 15
Dilated endometrial glands and stroma cause sponge-like appearance.

Tamoxifen-associated endometrial hyperplasia tends to contain more cystic areas.
Fig. 17: Figure 17
Fig. 18: Figure 18

Degenerated leiomyoma

Multicystic degeneration may occur in benign leiomyoma
Sponge-like masses: Others

Peritoneal lesion in lymphangioma

Dilated lymph vessels containing chylous - hemorrhagic lymph fluid

Fig. 19: Figure 19
Conclusion

SLM is a characteristic MR finding of some gynecologic pathologies, and useful to narrow the differential diagnosis.

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References


