A practical approach to cystic peritoneal masses and neoplasms: pearls and tips

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Learning objectives

- To review classification and imaging features of cystic peritoneal masses.

- To emphasize radiological features that help differentiate cystic peritoneal masses from intrabdominal processes that may mimic primary peritoneal cystic lesions.
Background

Cystic lesions within the peritoneum can be classified according to their lining on histology to four categories:

1. **Endothelial lining:**
   - Lymphangioma

2. **Epithelial lining:**
   - Duplication and enteric cysts
   - Mucinous cystadenoma / cystadenocarcinoma (ovarian or other), pseudomyxoma peritonei

3. **Mesothelial lining:**
   - Simple mesothelial cyst (congenital)
   - Peritoneal inclusion cyst / Benign cystic mesothelioma
   - Malignant cystic mesothelioma

4. **Other:**
   - Germ cell tumors: cystic teratoma
   - Stromal: sex cord gonadal stromal tumors (granulosa cell tumor), smooth muscle - cystic leiomyoma or leiomyosarcoma
   - Infectious: hydatid cyst (3 layers), tuberculosis (granulomatous)
   - Fibrous wall: traumatic intraperitoneal pseudocysts

There are many intra-abdominal collections which may mimic primary peritoneal cystic masses within the peritoneum such as abscess, seroma, biloma, urinoma or lymphocele and need to be characterized to do an appropriate diagnosis. These are often recognized based on relevant clinical history, such as recent surgery or trauma.
According to their lining on histology, cystic lesions within the peritoneum can be classified to four categories:

1. **ENDOTHELIAL LINING**

1.1 Lymphangioma:

Lymphangiomas are congenital benign vascular lesions resulting from developmental failure of the lymphatic system. They occur more commonly in children, though adult clinical presentation is not rare. The pathogenesis is vague but may represent embryologic remnants of lymphatic tissues with aberrant or obstructed outflow or arise from lymph sacs sequestered during development. Lymphangiomas mostly occur in the head, neck, or axillary region while rarely occur in the gastrointestinal tract. However, in the abdomen, these lesions can occur in the stomach, duodenum, jejunum, ileum, colon, mesentery and omentum. Abdominal lymphangiomas occur most commonly in the mesentery (Fig. 2 on page 13), followed by the omentum, mesocolon, and retroperitoneum (Fig. 3 on page 14). Other infrequent locations like the small and large bowel (Fig. 4 on page 15) have been described.

They rarely present with abdominal pain or acutely secondary to volvulus, so are usually discovered incidentally at endoscopy or on radiologic studies (Barium study or CT scan) performed for other reasons.

Primary solid or hollow organ abdominal organ lymphangiomas are rare. They may occur in isolation, or as part of systemic lymphangiomatosis. This entity is a rare disease with multifocal sites of lymphatic proliferation that typically presents during childhood and may involve multiple parenchymal organs (Fig. 5 on page 16) including the lung, liver, spleen, bone, and skin.

Splenic lymphangiomas tend to occur in subcapsular locations, secondary to the anatomic distribution of splenic lymphatics.

Lymphangiomas of the gallbladder are rare and often seen as multilocular cystic masses surrounding the gallbladder (Fig. 6 on page 17). Most common secondary symptoms are biliary colic due to mass effect on the cystic duct. Absence of communication between the biliary tract and lymphangioma is an important clue in the diagnosis. Septa within the lesion can be noted, are of uniform thickness and can enhance after intravenous contrast.

*Lymphangiomas characteristic imaging features are:*
US: Multiloculated cystic masses (Fig. 7 on page 18) that are usually anechoic or may contain echogenic debris.

CT: Cystic masses with enhancement of the wall and internal septa (Fig. 8 on page 19) are usually noted. The fluid component has low attenuation values. Fat attenuation values may occur in the presence of chyle. Calcification is uncommon (Fig. 3 on page 14).

MRI: Low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig. 2 on page 13), similar to signal intensity of fluid. In the presence of Chyle, signal drop may be seen in the opposed-phase chemical shift MR images (Fig. 9 on page 20).

Hemorrhage or infection in the lesion may alter the CT and MRI signal accordingly. Lymphangiomas have an insinuating nature which may make complete surgical excision difficult. Differentiating lymphangiomas from enteric duplications, mesothelial cysts, and pseudocysts may be difficult because the imaging features of these lesions overlap.

2. EPITHELIAL CYST

2.1 Enteric Duplication Cysts and Enteric Cysts

**Enteric Duplication Cysts** have an enteric mucosal lining and double-muscle lining with neural elements (reduplication of the bowel wall). The etiology of duplication cysts is uncertain. Persistent embryonic diverticulum, ischemia, and faulty bowel recanalisation have been suggested. They usually remain attached to the bowel and can occur anywhere along the gastrointestinal tract on the mesenteric side. Ileum is the commonest site and most manifest in the first year of life. Common symptoms are abdominal distention, vomiting, bleeding or a palpable abdominal mass in children. Rarely, enteric duplication cysts may act as lead point for an intussusception. Enteric duplication cysts may be associated with other vertebral or urogenital malformations. Gastric mucosa may be present in 17-36% of enteric duplication cysts and therefore should be considered as a differential diagnosis in children with gastro-intestinal bleeding. The treatment of choice for enteric duplications cyst is surgical excision.

US plays a critical role in the workup of pediatric abdominal masses. The double wall or muscular rim sign refers to the appearance of a cyst mimicking the gastrointestinal tract with an echogenic inner margin corresponding to mucosa surrounded by a hypoechoic rim of tissue representing the smooth-muscle layer (Fig. 10 on page 21). Identification of this sign on US of an abdominal mass is considered as characteristic of an enteric duplication cyst.

**Enteric Duplication Cysts characteristic US imaging features are:**
**US:** Anechoiec, unilocular, thick-walled cysts. Visualisation of an echogenic inner mucosal layer surrounded by a hypoechoiec muscular layer may help in the diagnosis. This double layered wall is not always circumferential and usually found in over 50% of cases. Sonographic visualization of the hypoechoic muscularis propria layer or identification of all five layers increases the specificity in making the sonographic diagnosis of duplication cyst.

**Enteric Cysts** as opposed to an enteric duplication cyst has a mucosal lining without the muscle layer. They are the result from migration of a small bowel or colonic diverticulum into the mesentery or the mesocolon and are lined with gastrointestinal mucosa.

**Enteric Cysts characteristic US imaging features are:**

**US:** Anechoiec, unilocular, thin-walled cysts within the mesentery or the mesocolon. No double wall or muscular rim sign are identified.

**2.2 Cystadenoma, Cystadenocarcinoma and Pseudomyxoma peritonei**

**Cystadenomas or cystadenocarcinomas** may arise from the ovary, pancreas or appendix and may appear as cystic.

- **Cystadenomas** are often thin-walled unilocular or multilocular cysts without significant solid component.

- **Borderline tumors** of the ovary may contain solid components and papillary projections and may metastases through the peritoneal cavity but are not true malignancies.

- Cystadenocarcinomas usually have extensive papillary projections and solid component. These may also be associated with local invasion and metastases.

Imaging findings that suggest malignancy are thick and irregular wall, thick septa, papillary projections and large component with necrosis. Peritoneal, omental and mesenteric implants as well as ascitis and adenopathy favours malignancy.

**2.2.1. Serous tumors** are the most common subtype of neoplasms in both the benign and malignant category. Psammomatous calcifications which may be associated with these tumors are easier to appreciate on **US** or **CT** (Fig. 11 on page 22). At **MR**, the signal intensity of the cyst contents of these tumors is variable but is usually low to intermediate on T1-weighted MR images and high on T2-weighted images.
2.2.2. *Mucinous tumors* may originate in the gastrointestinal tract (bowel *(Fig. 12 on page 23)*, pancreas) or ovary *(Fig. 13 on page 24)*. Mucinous cystadenomas tend to be larger than serous cystadenomas at presentation. Morphologically these are usually cystic and may be very large and multiloculated and at times their origin may not be certain on imaging. On **CT**, varying attenuation in the loculi and on **MR** varying signal intensities may be seen, due to proteinaceous, mucinous or hemorrhagic contents *(Fig. 14 on page 25)*. Appendiceal mucinous cystadenoma are uncommon and most often found in older patients, more commonly in females. Patients may present with chronic right lower quadrant abdominal pain secondary to distension of the appendix by mucus.

**Pseudomyxoma Peritonei**

The term pseudomyxoma peritonei refers to the accumulation of gelatinous material on intraperitoneal surfaces due to rupture of a benign or malignant mucin-producing tumor of the appendix, ovary, pancreas, stomach, colorectum, or urachus. Most relevant imaging features are loculated collections of mucinous fluid in peritoneal cavity, scalloping liver and splenic surfaces and displacing bowel loops. Initially seeds at sites of relative stasis and as large-volume disease develops, it fills the remaining spaces in peritoneal cavity. Clinically, progressive metastatic involvement of the peritoneal cavity may cause abdominal pain, increase in abdominal girth due to ascites, and vomiting or nausea due to bowel obstruction. Peritoneal metastases may appear as nodular deposits or may be sheath-like, simulating mesothelioma. They are often associates with ascites which at times may be loculated.

**Pseudomyxoma Peritonei characteristic imaging features are:**

**US:** Echogenic ascitis reflecting mucinous nature of fluid.

**CT:** Low-attenuation, frequently loculated fluid collection in the peritoneal cavity, omentum, and mesentery *(Fig. 15 on page 26)* and may scallop visceral surfaces, especially the liver. This is a differentiating feature from serous ascites at imaging. Curvilinear or punctate calcifications in the mucinous materials may also be identified.

**MRI:** Signal intensity of mucin on T1 and T2-weighted images is variable, depending on the mucin content. Watery mucin have lower signal intensity on T1-weighted images and higher signal intensity on T2-weighted images; whereas, loculi containing thicker mucin have a higher signal intensity on T1 and lower signal intensity on T2-weighted images.

**3. MESOTHELIAL LINING**

**3.1 Simple mesothelial cysts**

Mesothelial cysts result from mesothelial-lined peritoneal surfaces failing to coalesce. They are located in the small bowel mesentery and the mesocolon. They are thin-walled...
without muscular wall as seen with duplication cysts, usually unilocular cysts containing serous material.

*Mesothelial cysts characteristic imaging features are:*

**US:** anechoic, thin-walled, and without internal septations.

**CT and MRI:** simple cystic appearance (*Fig. 16 on page 27*)

### 3.2 Multilocular cystic mesothelioma (Peritoneal Inclusion Cyst)

Multilocular cystic mesothelioma also known as multiloculated peritoneal inclusion cyst are benign cystic pelvic masses secondary to nonneoplastic reactive mesothelial proliferation. It has a benign or indolent biological behavior and seems to occur predominantly in premenopausal females. Symptoms vary and include abdominal pain, palpable mass, dyspareunia, constipation, or urinary symptoms. The treatment of choice is total surgical excision.

*Multilocular cystic mesothelioma characteristic imaging features are:*

**US:** multiseptated anechoic cysts are seen. The multicystic locules may completely surround the ovaries such that the ovaries appear entrapped within the cystic lesion. The septations may be incomplete and may at times be thick, simulating an ovarian neoplasm.

**CT:** noncalcified septa and may better depict the extent of the process.

**MRI:** T1 hypointense and T2 hyperintense (typical signal intensity of water) and septal enhancement is common.

### 3.3 Malignant mesothelioma

Malignant mesothelioma has a couple of morphological presentations. It may present as a diffuse peritoneal process, which is usually clinically aggressive and usually incurable or a focal intraperitoneal mass, which carry a more favorable prognosis following complete surgical resection.

*Malignant mesothelioma characteristic imaging features are:*

Although these are predominantly solid tumors, as with peritoneal carciomatosis, there may be cystic nodules due to loculated ascites or internal degeneration.

### 4. OTHERS
4.1 Germ Cell Tumors: cystic teratoma

Mature cystic teratoma is a tumor composed of well-differentiated derivations of the 3 germ cell layers and is usually encountered in the gonads. Rarely, they may occur in the mesentery or omentum, primarily in pediatric patients. Mature teratoma is the most common benign tumor in women younger than 45 years and constitutes 5-25% of all ovarian neoplasms.

*Cystic teratoma characteristic imaging features are:*

**US:** anechoic well-defined cystic lesions which may contain peripheral echogenic foci with acoustic shadowing, due to calcifications and may contain some echogenic material within, corresponding to fatty component *(Fig. 17 on page 28).*

**CT:** fat attenuation (-90 to -130 HU) within a cyst is diagnostic.

**MR:** On T1 sequences hyperintense sebaceous/fat component within these cysts is easily appreciated. Calcification, bone, hair and fibrous tissue are low signal intensity. On T2 sequences hyperintense cystic mass is appreciated with variable signal intensity of sebaceous component *(Fig. 18 on page 29).*

4.2 Sex cord gonadal stromal tumors: granulosa cell tumor

There are two subtypes of granulosa cell tumor, adult and juvenile and are characterized by different age of presentation and natural history and differences in histologic characteristics. The juvenile form may be hormonally active, secreting estrogen and therefore may cause precocious puberty. The adult form typically occurs in women over 40 and represents the common form accounting for almost 95% of all granulosa cell tumors. Metastases may occur through direct extension and intraperitoneal seeding, or hematogeneously to the lungs, liver and brain.

*Granulosa cell tumor characteristic imaging features are:*

**US:** Large anechoic multiloculated cystic mass with thin or thick internal septations, and solid component. Heterogeneous echogenicity has been described if hemorrhage, fibrosis or necrosis are present. Unilocular and solid appearances are uncommon. Thickened endometrium with cystic changes can be associated due to tumor secretes estrogen.

**CT:** Solid enhancing mass with variable cystic or hemorrhagic/degenerating areas of low attenuation *(Fig. 19 on page 30).*

**MRI:** High T1 content within the cysts is typical, reflecting intrallesional hemorrhage. On T2 sequences common appearance is a multilocular cystic/solid mass. Thick septations may
have low signal intensity. Enlarged uterus with thick and T2 hyperintense endometrium can be detected.

4.3 Cystic mesenchymal tumors

Gastrointestinal stromal tumours (GISTs) comprise a group of smooth muscle mesenchymal gastrointestinal tract tumours of variable malignancy, with the vast majority (70-80%) being benign leiomyomata. GISTs are the most common mesenchymal tumors of the gastrointestinal tract. The most common GISTs presentation is a bulky abdominal soft tissue mass without lymphadenopathy. These are often solid, with variable degrees of necrosis within the mass, depending on tumor size. Many GISTs achieve enormous size before diagnosis and demonstrate considerable cystic change and at times may appear predominantly cystic (Fig. 20 on page 31) as well as with intratumoral hemorrhage (Fig. 21 on page 32).

CT has overall sensitivity of 87% for GIST and is ideal for delineating tumor extent and identifying metastatic disease.

There are other very rare tumors that may present as complex cystic masses within the peritoneal cavity including primary leiomyosarcoma, angiosarcoma and synovial sarcoma of the peritoneum.

4.4 Fibrous wall: intraperitoneal pseudocysts

Intraperitoneal pseudocysts are thought to be secondary to liquefaction in a hematoma or an abscess that failed to reabsorb completely. These cysts are not related to the pancreas and they have a fibrotic thick-wall. They are usually septated and often contain hemorrhagic and purulent contents. Nonpancreatic pseudocysts usually present with abdominal pain and distention. History of previous trauma may occasionally be present.

*Intraperitoneal pseudocysts characteristic imaging features are:*

**US:** Thick-walled cysts with echogenic debris

**CT:** Thick walled cysts with heterogeneous appearance due to internal hemorrhagic or infection (Fig. 22 on page 33).

**MR:** Fluid-fluid level secondary to hemorrhagic, pus or chylous content. Chylous content can lead to a fat-fluid level on imaging.

4.5 Infectious:
There are infectious processes which may affect the peritoneal cavity and present as cystic lesions. These include tuberculosis (TB) and intraperitoneal dissemination of echinococcus.

**Tuberculosis (TB):** Abdomen is the most common site for extrapulmonary TB and abdominal lymphadenopathy is the most common manifestation of abdominal TB. It is often within the abdomen to note enlarged nodes with hypoattenuating center (characteristic of caseous necrosis) on CT *(Fig. 23 on page 34)* and hyperattenuating enhancing rims.

**Hydatid (Echinococcal) Disease:** Peritoneal echinococcosis is almost always secondary to hepatic disease, due to rupture of hepatic cyst, spontaneously or secondary to surgery. Very rarely primary peritoneal involvement has been described. Although hepatic and pulmonary involvement is well-recognized, peritoneal involvement is less prevalent, reported in approximately 13% of cases. CT is the modality of choice in affected patients because it allows imaging of the entire abdomen and pelvis. Diagnosis of hydatid disease can be easily made when the cyst has a typical appearance with internal daughter cysts, floating membranes and matrix and a diagnosis may be suggested if cyst shows peripheral calcifications *(Fig. 24 on page 35).* If hydatid cysts have unilocular morphology with no internal architecture are then difficult to differentiate from mesenteric cysts, or intestinal duplication cysts.

MRI is necessary in these situations showing a distinctive hypointense rim on T2-weighted images that may aid in making the correct diagnosis when other features are absent. This low signal intensity is due to abundant collagen content of the pericyst.

Besides all these, there are many intrabdominal processes which may mimic cystic masses within the peritoneal cavity. These include various fluid collections such as abscess, seroma, biloma, urinoma or lymphocele.

These are often recognized based on relevant clinical history, such as recent surgery or trauma. For example, penetrating or iatrogenic injury may result in intraperitoneal urine leak which may encapsulate and mimic a cystic mass. Even when not suspected clinically, the diagnosis of urinoma can be confirmed by demonstration of contrast collecting within the fluid collection on delayed post-contrast imaging. Alternatively, a thin-walled homogeneous fluid collection abutting surgical clips after lymphadenectomy is suggestive of the diagnosis of lymphocele *(Fig. 25 on page 36).* Other specific characteristics of certain collections may also facilitate diagnosis: gas within a collection suggests abscess or infected collection; on MR, high T1 signal within a fluid collection on fat-suppressed images is suggestive of blood products, implying possibility of a hematoma or seroma. These collections need to be identified and differentiated from
primary cystic masses as some of these collections (abscess, urinoma or biloma) may require urgent intervention.
A practical approach to cystic peritoneal masses and neoplasms: pearls and tips

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Fig. 1: Cover

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Fig. 2: Mesenteric Lymphangioma. a. Axial T2-weighted MR image showing a high signal lymphangioma within the mesentery. b. Axial T1-weighted MR image showing a low signal lymphangioma within the mesentery. c. Transverse US of the right abdomen shows a multiloculated cystic mass with multiple thin septa (green arrow) and mild echogenic debris (blue arrowhead).

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**Fig. 3:** Retroperitoneal Lymphangioma. Axial contrast-enhanced CT image shows cystic retroperitoneal lobulated mass which is surrounding the abdominal aorta (blue arrow). Note tiny calcifications within the mass (orange arrowhead).

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**Fig. 4:** Colonic lymphangioma. a, b. Coronal contrast-enhanced CT image shows fluid-attenuation mural mass (arrow) in the right colon. c. Axial contrast-enhanced CT image shows fluid-attenuation mural mass (arrow) in the posterior aspect of the right colon. d. Endoluminal 3D CT colonographic image shows a lobulated mass in the ascending colon (arrow).

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**Fig. 5:** Diffuse Lymphangiomatosis. Axial T2-weighted MR image shows diffuse lymphangiomatosis. Multiple cystic polilobulated masses (arrows) involving the spleen (a) and the retroperitoneum (b,c) are noted.

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**Fig. 6:** Gallbladder Lymphangioma. Axial (a) and Coronal (b,c) contrast-enhanced CT image shows cystic polilobulated mass surrounding the gallbladder (blue arrow). Note a thin septa within the cystic mass (orange arrowhead). Cholelithiasis are noted within the gallbladder lumen.

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**Fig. 7:** US appearance of an abdominal lymphangioma. US shows a multiloculated cystic mass which is anechoic with echogenic debris (blue arrowhead) and internal thin septa (red arrow).

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**Fig. 8:** CT appearance of a Lymphangioma with internal septa. Coronal contrast-enhanced CT image shows a cystic mass in the left hemiabdomen with thin internal enhancing septa (curved arrow).

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Fig. 9: Mesenteric lymphangioma with internal presence of chyle. a. Axial contrast enhanced CT shows small mesenteric cystic mass (red arrow) in keeping with small lymphangiomma. b. Axial in-phase MR image shows a predominantly isointense round lesion in the mesentery (yellow arrow). c. Axial out-of-phase MR image shows dramatic signal loss (yellow arrow) relative to the signal intensity on the in-phase image, finding that confirms the presence of water and lipid lesion content.

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Fig. 10: Duplication Cyst in a newborn (Double Wall sign). Transverse sonogram reveals an anechoic, unilocular, thick-walled cyst in the mid-abdomen. Echogenic inner mucosal layer (1) is seen surrounded by a hypoechoic muscular layer (2) giving a double layered wall.

Fig. 11: Serous cystadenocarcinoma of the ovary. Axial contrast enhanced CT shows a large multiloculated cystic mass arising from the pelvis (d) (yellow asterisk) and extending superiorly into the peritoneal cavity. Note there is enhancing soft tissue within the mass (a) (red arrow) and calcifications within the mass related to psammomatous calcifications (b) (blue arrow).

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**Fig. 12:** Mucinous colon carcinoma. Axial contrast enhanced CT shows extensive cystic peritoneal disease involving all the abdomen and pelvis. Note the diffuse omental infiltraton (b,c) (asterisk) by mucinous tumoral infiltration.

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Fig. 13: CT appearance of mucinous cystadenocarcinoma of the ovary. Axial contrast enhanced CT shows a multiloculated predominantly cystic mass in the pelvis with numerous enhancing internal septa (green arrows) in pelvis.

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**Fig. 14:** MRI appearance of mucinous cystadenocarcinoma of the ovary. a. Axial T1-weighted MR image pre-contrast. b. Axial T1-weighted MR image after contrast. c. Axial T2-weighted MR image. There is evidence of a large complex cystic predominantly T2 hyperintense mass originating from the left ovary (not shown) with some solid areas with avid enhancement after intravenous contrast (red arrows). The lesion contains loculated small cystic areas, some of them demonstrating fluid-fluid level (yellow arrow) with T1 hyperintense component probably related to proteinaceous, mucinous or hemorrhagic contents.

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Fig. 15: Pseudomyxoma Peritonei. Axial contrast enhanced CT shows extensive cystic peritoneal disease involving the mesentery (red arrow) and omentum (yellow arrow). Cystic pelvic complex masses are noted (asterisk).

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**Fig. 16:** Simple mesothelial cyst. Axial contrast enhanced CT shows a well defined cystic lesion in the mesentery, avascular and thin wall (red arrow). No solid component is noted within the lesion.

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**Fig. 17:** Cystic teratoma. Transverse sonogram shows complex cystic and solid mass in the right ovary with an echogenic solid appearance peripheral nodule related to fatty content (red arrow).

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Fig. 18: Cystic teratoma. a. Axial T2-weighted MR image shows in the right midabdomen arising from the ovary (not shown) a complex hyperintense cystic mass (red arrow) with large round intralesional hypointense components (green asterisks). b. Axial T1-weighted MR image shows the mass diffusely hypointense with hyperintense round intralesional components. Axial in-phase T1 GRE (c) and out-of-phase T1 GRE (d) MR images show signal loss on the out-of-phase compared to the in-phase sequences suggesting microscopic fat (yellow arrows).

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**Fig. 19:** Granulosa cell tumor. Non-contrast enhanced axial CT image shows large multicystic mass with internal septations in left mid abdomen (red arrow).

**Fig. 20:** Gastrointestinal stromal tumor (GIST) with central necrosis. Axial contrast enhanced CT shows a large predominantly necrotic mass in the proximal small bowel mesentery. The periphery of the lesion is solid in appearance (red arrows), with evidence of enhancement after intravenous contrast. The center of the mass is hypoattenuated, with cystic appearance secondary to tumoral necrosis (asterisk).

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Fig. 21: Hemorrhage within an exophytic GIST, appearing as a cystic mass. Axial contrast-enhanced CT image shows cystic mass (red arrow), with linear high attenuation within due to intravenous contrast extravasation in keeping with ongoing active bleeding (small yellow arrowheads).

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Fig. 22: Traumatic peritoneal pseudocyst. a. Axial contrast-enhanced CT image shows a cystic complex mass (red arrow) in the left upper quadrant adjacent to the splenic hilum. Note there are hyperdense content and some septations within the cystic lesion. b. After several months there is evidence of resolution of the complex cystic mass.
Fig. 23: Abdominal Tuberculosis (TB). Lymphadenopathy. a,b. Axial contrast-enhanced CT image shows enlarged lymphadenoapthy within the retroperitoneum (a)(red arrow) and pelvis (b)(blue arrow). Characteristically these lymphadenopathy have hypodense center (characteristic of caseous necrosis) and peripheral rim enhancement, findings highly suspicious for TBC.

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Fig. 24: Hydatid disease. a. Contrast-enhanced CT axial image shows hepatic cysts some of which are peripherally calcified (green arrow). b,c,d. Contrast-enhanced CT shows several fluid attenuation round lesions within the abdomen and the pelvis in keeping with multiple hydatid cysts (red arrows)

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**Fig. 25:** Lymphocele following pelvic lymphadenectomy for endometrial cancer. Coronal T2-weighted image show adjacent to the right iliac vessels a thin-walled fluid collection (red arrow) just medial to a surgical clip (yellow arrowhead) related to small lymphocele secondary to recent surgery.

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Conclusion

Most primary cystic peritoneal masses have specific imaging features which can help in accurate diagnosis and management.

Knowledge of the imaging spectrum of these entities is necessary to distinguish from other abdominal masses.

**Pearls to remember:**

- Peritoneal cysts may be classified according to their lining as endothelial, epithelial, mesothelial or other.
- Thorough clinical history and specific imaging characteristics may help differentiate intra-abdominal collections from cystic masses.
- Lymphangiomas are benign multilocular cystic masses that can virtually occur in any location within the abdomen and insinuate between structures. Knowledge of the imaging spectrum of abdominal lymphangiomas is necessary to help distinguish from other cystic abdominal masses.
- Ultrasound may help differentiate enteric duplication cysts from other mesenteric and omental cysts in the abdomen. Double-layered wall along the mesenteric side of bowel may suggest its diagnosis in the proper clinical setting.
- Pseudomyxoma peritonei appears as loculated fluid collections in the peritoneal cavity, omentum, and mesentery and may scallop visceral surfaces.
- Characteristic imaging features of hydatid cysts are internal daughter cysts, floating membranes and matrix, peripheral calcifications, and a collagenous pericyst.
References

- Inoue Y, Nakamura H. Adenocarcinoma arising in colonic duplication cysts with calcification: CT findings of two cases. Abdom Imaging 1998; 23:135-137
- Rose JS, Gribetz D, Krasna IH. Ileal duplication cyst: the importance of sodium pertechnetate Tc 99m scanning. Pediatr Radiol 1978; 6:244-246
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