Retroperitoneal Cystic Masses: an overview of CT and MRI findings

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Learning objectives

- To present and illustrate the CT and MR imaging features of different types of retroperitoneal cystic lesions.
- To list the main key points used in the interpretation of retroperitoneal cystic mass in purpose to make a correct diagnosis.

Background

ANATOMIC CONSIDERATIONS:

Anatomical compartments of the retroperitoneum are:

a) **Centromedial compartment** is delimited upper by diaphragmatic, esophageal, and aortic openings; lower by sacral promontories and lateral by psoas muscles, and contains the abdominal aorta, inferior vena cava, pancreas, duodenum (partial) (12).

b) **Lateral compartment** has the following reports: upper - diaphragm; lower - iliac crests and lateral - psoas muscles. (12) The contents of the compartment are: kidneys and their vessels, ureters and their abdominal parts, ascending and descending colon, hepatic and splenic flexure (12).

c) **Pelvic compartment** is bounded by the space of Retzius in anterior; sacrum in the posterior and bony pelvis in lateral (12). This compartment contains: pelvis in toto, pelvic wall, recto-sigmoid colon, iliac vessels, urogenital organs (partial) - Fig. 1 on page 6, Fig. 2 on page 7

The perirenal fascia devides the retroperitoneal space in (2):

- **the anterior pararenal space (APS)** is surrounded by the transversalis fascia (7)
- **the perirenal space (PRS)** bounded by the perirenal fascia (8).
- **the posterior pararenal space (PPS)** is bounded by the posterior parietal peritoneum and the latero-conal fascia lateral.

The three retroperitoneal compartments are delimited by the perirenal interfascial plane, represented by: **the retromesenteric plane (RMP)**, **retrorenal plane (RRP)**, **lateral conal plane (LCP)** and **the combined interfascial plane (9).**
### Table nr.1. Classification of retroperitoneal cystic masses - median compartment - NON NEOPLASTIC LESIONS (1,6,13,14,16,17,19, 20,22, 23)

**MEDIANcompartment- NON NEOPLASTIC LESIONS**

<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>CT</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic pseudocyst</td>
<td>-a well-defined round or oval fluid collection with enhancing walls;</td>
<td>-T1 hypo-intense (fluid signal) centre;</td>
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<td></td>
<td>-other features of acute pancreatitis may also be seen;</td>
<td>-T1 wall demonstrates mild early enhancement, which progressively becomes more intense;</td>
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<tr>
<td></td>
<td></td>
<td>-T2 hyperintense (fluid signal);</td>
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<td>-T2 layering or dependent debris, highly specific;</td>
</tr>
<tr>
<td>Urinoma</td>
<td>-fluid collection with water attenuation;</td>
<td>-water attenuation, low signal intensity on T1-weighted imaging;</td>
</tr>
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<td></td>
<td>-the attenuation can increase progressively after intravenous administration of contrast material because contrast-enhanced urine enters the urinoma;</td>
<td>-very high signal intensity on T2-weighted imaging, similar to simple fluid elsewhere in the body;</td>
</tr>
<tr>
<td>Hematoma</td>
<td>-acute and subacute hematomas: heterogeneous high attenuation;</td>
<td>-acute and subacute hematomas: hyperintense on T1- and T2-weighted images;</td>
</tr>
<tr>
<td></td>
<td>-chronic hematomas: low attenuation;</td>
<td>-chronic hematomas: low signal intensity on MR images because of hemosiderin deposition;</td>
</tr>
<tr>
<td>Abscess</td>
<td>-lesion of low attenuation;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-ring enhancement</td>
<td></td>
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</tbody>
</table>

### Table nr.2. Classification of retroperitoneal cystic masses - median compartment - NEOPLASTIC LESIONS (1,6,13,14,16,17,19, 20,22, 23)
<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>CT</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphangioma</td>
<td>- unilocular or multilocular cysts;</td>
<td>- low signal intensity on T1-weighted images;</td>
</tr>
<tr>
<td></td>
<td>- large, thin-walled, multiseptate cystic mass;</td>
<td>- high signal intensity on T2-weighted images;</td>
</tr>
<tr>
<td></td>
<td>- the fluid may be serous, chylous, or hemorrhagic;</td>
<td>- a large amount of chyle, with high signal intensity on T1-weighted</td>
</tr>
<tr>
<td></td>
<td>- rarely includes calcification;</td>
<td>images and intermediate signal intensity on T2-weighted can alterate</td>
</tr>
<tr>
<td></td>
<td>- high signal intensity on T1-weighted images;</td>
<td>the MR images;</td>
</tr>
<tr>
<td></td>
<td>- intermediate signal intensity on T2-weighted images;</td>
<td>- loss of fat signal intensity on fat-suppressed MR images;</td>
</tr>
<tr>
<td></td>
<td>- thicker, irregular, and nodular septa that show enhancement</td>
<td>- thicker, irregular, and nodular septa that show enhancement</td>
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<td></td>
<td>after contrast material administration;</td>
<td>after contrast material administration;</td>
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<tr>
<td>Liposarcoma with cystic component</td>
<td>- enhancing soft tissue components;</td>
<td>- T1-typically low signal;</td>
</tr>
<tr>
<td></td>
<td>- heterogenous mass;</td>
<td>- T2-typically high signal;</td>
</tr>
<tr>
<td></td>
<td>- varying amount of fat and soft tissue;</td>
<td></td>
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<tr>
<td></td>
<td>- multiple septae;</td>
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</tr>
<tr>
<td>Pseudomyxoma</td>
<td>- multicystic masses with thick walls;</td>
<td>- a heterogeneous mass, which is isointense on T1-weighted images and</td>
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<td></td>
<td>- septa that displace and distort adjacent structures;</td>
<td>hyperintense on T2-weighted images;</td>
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<td></td>
<td>- curvilinear or punctate mural;</td>
<td></td>
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<tr>
<td></td>
<td>- +/- calcifications.</td>
<td></td>
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<tr>
<td>Synovial sarcoma</td>
<td>- hypoattenuating, with peripheral irregular enhancement and central</td>
<td>- areas of hemorrhage, necrosis or cyst formation within the tumor.</td>
</tr>
<tr>
<td></td>
<td>areas of necrosis;</td>
<td></td>
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<tr>
<td></td>
<td>- soft tissue calcifications,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- a heterogeneous mass, which is isointense on T1-weighted images and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hypointense on T2-weighted images;</td>
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</tbody>
</table>
GIST
-well-circumscribed, heterogeneous, centrally necrotic tumors.

Neuroblastoma
-such features contrast with the regular contours, homogeneous density, and intraluminal growth patterns that are characteristic of smaller benign GISTs.

Lymphoma with cystic transformation
-as a well-defined homogeneous mass, with mild homogeneous contrast enhancement, that spreads between normal structures without compressing them.
-
-calcification and necrosis are unusual before therapy.

Table nr. 3: Classification retroperitoneal cystic masses-iliopsoic compartment-
NON-NEOPLASTIC and NEOPLASTIC LESIONS (1,6,10, 13,19,24).

ILIOPSOIC COMPARTMENT

A. NON NEOPLASTIC CT MRI LESIONS

Abscess
-lesion of low attenuation;
-ring enhancement;
-inflammatory reactions in the retroperitoneum.

-lesion of low attenuation;
-ring enhancement;
- inflammation and occasionally gas bubbles and bone destruction;

**Lymphocele**
- a low-attenuation;
- rarely negative attenuation values due to fat within the fluid;
- rarely calcification of the lymphocele wall may;
- enhancing thick wall suggests superinfection;
- high signal T2 SE, High SS short and long T;
- low signal T1;

**Hematoma**
- acute and subacute hematomas: heterogeneous high attenuation
- chronic hematomas: low attenuation
- acute and subacute hematomas: hyperintense on T1- and T2-weighted images.
- chronic hematomas - low signal intensity on MR images because of hemosiderin deposition.

**B. NEOPLASTIC LESIONS**

**Cystic teratoma**
- mass containing a well-circumscribed fluid component, adipose tissue, and calcification.
- hypointensuating fat within the cyst.
- reserved for difficult cases, but is exquisitely sensitive to fat components.

**Mesothelioma**
- multilocular thin-walled cystic lesion
- multilocular thin-walled cystic lesion

**Images for this section:**
Fig. 1: Axial view of retroperitoneal space compartments: APR - anterior pararenal space; PPS - posterior pararenal space; PRS - perirenal space.
Fig. 2: Axial view of ilio-psoic compartment.
Findings and procedure details

TECHNIQUES

Multislice CT

1. **Unenhanced MSCT** series were programmed to include the abdomen and pelvis.
2. **Enhanced MDCT** was done in arterial, venous and parenchymal phase. All patients received 1.5 mL/Kg of a nonionic iodinated contrast (350-370 I mg/mL) with a monophasic injection using a power injector. The contrast material was administrated at a rate of 2.5-3 mL/s in all patients. CT acquisition was initiated 25-30 seconds for the arterial phase, 60-80 seconds for venous phase and at 180-200 seconds for the parenchymal phase after the injection of contrast began. In particular cases, we have performed late excretory phase (after 30-60 minutes).

The aim of **CT evaluation** is to:

- assess the location, the extent of the lesion and the involvement of adjacent and distant anatomical structures,
- detect the lesion components: calcifications, air, hemorrhage, fat, solid and cystic structures,
- evaluate the degree of the enhancement.

Magnetic Resonance Imaging (MRI)

MRI intensity field: 1.5 T; phased array coil-Torsopa;

Protocol: **T1-weighted FSPGR FatSat** and **T2-weighted FSE FatSat** in axial plane; **T2 ssFSE short TE** in coronal plane and **T1-weighted 3D FAME acquisition** before and after Gadolinium (0.1 ml/kgc) iv.injection in arterial, venous and equilibrium phase. In particular cases, we have performed late excretory phase (after 30-60 minutes).

**MRI evaluation** is very useful for:

- staging,
- the assessment of vascular invasion,
- evaluating the fat content of lesions.

IMAGING FINDINGS:

We reviewed imaging characteristics of non-neoplastic and neoplastic retroperitoneal cystic lesions from cases explored in our department.
I. Non-neoplastic lesions

- **Lymphocele**: Low density fluid collection/signal similar to fluids (digestive, bile, urine, CSF) on T1 and T2-weighted, when uncomplicated. CT and MRI delayed acquisitions plays an important role in the differentiation from urinomas - Fig. 3 on page 11, Fig. 4 on page 12

- **Mature pancreatic pseudocyst**: Fluid accumulation in pancreatic lodge bounded by an own contrast-enhanced thin wall, associating other features of acute or chronic pancreatitis - Fig. 5 on page 13

- **Arterialised pancreatic cyst**: A cystic lesion of the pancreas, containing a circulating area which is enhancing similar to arterial structures secondary to an eroded artery - Fig. 6 on page 14

- **Abscess**: Fluid-parafluid accumulation often bounded by a thick enhanced wall, associating inflammatory reactions - Fig. 7 on page 15, Fig. 8 on page 16

- **Phlegmon**: Mixed accumulation with diffuse or localized gas. In such cases, the CT evaluation is superior in highlighting the small gaseous accumulations - Fig. 9 on page 17, Fig. 10 on page 18

- **Cold abscess**: Fluid collections having as elective location psoas muscle and paravertebral region, accompanied by classical signs of vertebral spondylodiscitis - Fig. 11 on page 19

- **Hematoma**: Collection with hematic density depends on their size and time course (acute/chronic/mixed density collection). MRI evaluation is superior in the characterization of old hematic collections - Fig. 12 on page 20

- **Urinoma**: Perirenal fluid collection with density which varies from water to contrast-opacified urine. In these situations the most useful acquisition is the excretory-phase (CT-urography or MR-urography with Gd) - Fig. 13 on page 21

II. Neoplastic lesions

- **Lyposarcoma**: Heterogenous mass including enhancing areas, multiple septa and fluid component. MRI is superior to CT evaluation in detecting lipomatous components using T1-WI sequence with TE in-/out of phase - Fig. 14 on page 22

- **Synovial sarcoma**: Can appear like hypoattenuating mass, with peripheral irregular enhancement and central areas of necrosis, but there are no typical imaging criteria - Fig. 15 on page 23, Fig. 16 on page 24
• **Neuroblastoma:** A heterogeneous mass with cystic component and areas of necrosis, tending to encase vessels and may lead to compression; adjacent organs can be displaced. The specific locations of the tumor are: adrenal glands (most common) and retroperitoneum (organ of Zuckerkandl, coeliac axis, paravertebral sympathetic chain). Metastatic disease is frequently found and has a variety of patterns like: liver (diffuse infiltration or focal hypoenhancing masses); lung and pleura (discrete nodule and diffuse consolidation) and brain and meninges (rarely)- Fig. 17 on page 25, Fig. 18 on page 26

• **Gastrointestinal stromal tumor (GIST):** Cystic mass with solid components in the periphery. Rarely can appear in the retroperitoneal space. Voluminous tumors frequently are heterogeneous-Fig. 19 on page 27

• **Leiomyosarcoma:** An expansive process with dominant cystic component and irregular enhanced thick wall. There is no typical imaging criteria that can conclude this diagnosis-Fig. 20 on page 28

• **Non hodgkin lymphoma (NHL):** Lymph nodes partially necrotic-Fig. 21 on page 29

• **Retoperitoneal carcinoma:** Cystic mass with an enhancing wall; but currently there are not known typical imaging criteria- Fig. 22 on page 30

• **Leiomyoma:** Cystic lesion with uniform thickness wall and internal irregularly contour. There is no certain and typical imaging criteria for this kind of lesion-Fig. 23 on page 31

• **Myxomatous tumor:** A mass containing tissue and cystic areas. There is no typical imaging criterias known which can certify the presence of this type of tumor- Fig. 24 on page 32

**WHAT MUST CONTAIN THE IMAGING REPORT?**

- **location of the lesion(s)**-referring to retoperitoneal compartments and the involvement of adjacent and distant anatomical structures;
- **the imaging findings:** size, shape, contours, structure- wall thickness, septa, calcifications, necrotic, air, fluid, hemorrhagic, solid and fat content;
- **signs of complications**.

**Images for this section:**
Fig. 3: Lymphocele. Axial enhanced (a) and non-enhanced (b, c) CT showing a homogeneous hypoattenuating mass (arrows), regular smooth walls, with para ilio-psoic topography, post lymphodissection.
Fig. 4: Lymphocele. Functional renal graft with II grade hydronephrosis by a left iliac extrinsic ureteral compression due to fluid collection explored by MRI in T2-WI (a - axial plane; b,c - coronal plane), T1-WI (e - axial plane); T1-WI FS+Gd ( d,g- coronal plane, f -axial plane).
**Fig. 5:** Mature pseudocyst - Non-enhanced (a) and enhanced (b, c, d) axial CT images shows a fluid accumulation (arrows), bounded by a relatively thin and uniform wall, located into the pancreatic lodge.
Fig. 6: Arterialised pancreatic pseudocyst- Non-enhanced (a) and enhanced (b, c, d) axial CT images shows a cystic mass developed in the cephalo-isthmic region, containing a circulating area which enhances similar to the vascular structures secondary to the erosion of the gastroduodenal artery.
**Fig. 7:** Abscess - Axial non-enhanced (a) and coronal contrast-enhanced (b, c) CT shows a multiloculated fluid-parafluid accumulation (arrows), bounded by an discretely enhanced wall, developed into the psoic muscle compartment (head arrow).
Fig. 8: Left para-/intrapsoic abscess - MRI evaluation shows paravertebral fluid accumulation with heterogeneous signal in axial T2-WI (a), coronal STIR (c), coronal T1+Gd (b).
Fig. 9: Phlegmon - Axial non-enhanced (a, c, d, e) and enhanced (b) CT shows a mixed accumulation with hydroaeric level located in right peri-/pararenal posterior space extended in ilio-psoic compartment and into the lumbar square muscle.
**Fig. 10**: Phlegmon - MRI evaluation showing a mixed collection with hydroaeric level, developed predominantly in posterior pararenal space in coronal T1+Gd (a,b,e), T1-WI (c), short ss FSE TE (d). Note: Small scleroatrophic kidneys.
Fig. 11: Paravertebral cold abscesses - MRI evaluation shows thoracal (T9-T11) and lumbar (L3-L4) TBC spondylodiscities with psoas muscles and paravertebral cold abscesses.
Fig. 12: Hematoma - Non-enhanced (a - axial plane) and enhanced (b - coronal oblique plane in arterial phase, c - axial plane in arterial phase, d - axial plane in excretory phase) CT shows a mixed accumulation with hematic component (arrows) suggestive for an old hematoma with rebleeding (arrows).
Fig. 13: Urinoma - Non-enhanced (a - axial plane) and enhanced (b - nephrographic phase, c - excretory phase) axial CT images shows fluid accumulation located in left posterior peri-/ and pararenal space with extravasation of contrast in the excretory phase (curved arrow).
Fig. 14: Liposarcoma - Non-enhanced (a - axial plane) and enhanced CT images (b - axial portal phase, c - sagittal portal phase) shows an expansive process including enhanced areas (arrow) and fluid component developed in anterior peri-/ and pararenal space. Histopathologic exam: liposarcoma (d).
**Fig. 15**: Synovial sarcoma - Enhanced CT images (a - coronal plane, b - sagittal plane, c - axial plane) shows an inter-aortico-cav cystic mass bounded by a wall with an unequal thickness with mass effect on the IVC. Histopathologic exam: synovial sarcoma.
Fig. 16: Synovial sarcoma. Axial enhanced CT (a,b,c,d) shows an cystic mass with mixed structure, including enhanced areas, located in the left anterior pararenal space and extended in parapsoic compartment. Histopathologic exam: Synovial sarcoma.
Fig. 17: Neuroblastoma - Axial enhanced CT images (a,b,c) shows a heterogeneous mass with cystic-like (head arrow) and enhanced areas (arrow) included, located in the right retroperitoneal space, with invasion of right kidney, embedding the vascular pedicle of it, dislocation of inferior vena cava and incorporating the aorta. Histopathologic exam: Neuroblastoma
Fig. 18: Neuroblastoma - Enhanced CT images (a,b - axial plane, d - coronal plane), and MRI evaluation: axial T2-WI (c), coronal STIR (e) shows a large left retroperitoneal heterogeneous mass with cystic-like, necrotic and solid enhancing areas included, with loco-regional invasion. Note: liver metastasis. (arrow head). Histopathologic exam: neuroblastoma.
**Fig. 19:** GIST - Axial enhanced CT images evoke an anterior pararenal large cystic mass with solid components in the periphery (arrow). Histopathologic exam: GIST
Fig. 20: Leiomyosarcoma - Non-enhanced CT (a - coronal view, b, c, d - axial plane) showing an expansive process with dominant cystic component and irregular enhanced thick wall (arrow) developed in iliopsoic compartment. Histopathologic exam: Leiomyosarcoma
Fig. 21: NHL - Non-enhanced (c,d - axial plane) and enhanced (a,b - axial plane) CT images. Retroperitoneal lymph nodes with necrotic areas. Histopathologic exam: B Cell Non Hodgkin Lymphoma
Fig. 22: Carcinoma - Non-enhanced (a - axial plane) and enhanced (b - axial portal phase) CT images. Retroperitoneal cystic mass surrounded by an enhancing wall (arrow). Histopathologic exam: Connective tissue fragment showing solid carcinoma areas, poorly differentiated (possible primitive urothelial or pancreatic primitive origin).
Fig. 23: Leiomyoma - Non-enhanced (f - axial plane) and enhanced (g - axial portal phase, h - coronal portal phase) CT images, and MRI evaluation coronal T1-WI (a); coronal SS FSE short TE (b); coronal SS FSE long TE (c); coronal/axial T1 + Gd (d/e) shows a voluminous cystic lesion delimited by a relatively uniform wall thickness with internal irregularly contour, located in right flank and iliac fossa. Histopathologic exam: leiomyoma.
Fig. 24: Myxomatous tumor. MRI evaluation: axial T2-WI (a,c), coronal SS FSE short TE (b), coronal T1+Gd (d) shows a retroperitoneal tumoral lesion extended to the latero-abdominal wall, involving the right ilio-psoic muscle; the mass contains tissue and cystic areas. Histopathologic exam: myxomatous tumor
Conclusion

• Deep analysis of imaging findings together correlate with the clinical history and physical examination conclusions can often facilitate an accurate diagnosis and treatment.

• In cases with non-specific CT or MR findings, US, CT or MR guided biopsy and histopathological exam are considered the gold standard for a positive diagnosis.

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References


