Retroperitoneal masses

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Authors: S. Dutra\textsuperscript{1}, R. Amaral\textsuperscript{1}, D. N. Silva\textsuperscript{1}, D. Garrido\textsuperscript{1}, S. Serpa\textsuperscript{1}, I. C. S. P. Basto\textsuperscript{1}, P. Cordeiro\textsuperscript{2}; \textsuperscript{1}Ponta Delgada/PT, \textsuperscript{2}Coimbra/PT
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Learning objectives

The purpose of this poster is to review various retroperitoneal masses of our institution and the imaging features, with emphasis on CT imaging findings. The anatomy of the retroperitoneal space is briefly reviewed.

Background

Retroperitoneal masses can arise from various tissues and can result from a wide variety of disease processes. Although a specific diagnosis might be difficult to determine because of overlapping imaging appearances, the identification of certain characteristic imaging features, like determining the tumor location and recognizing specific features of various retroperitoneal masses (evaluating patterns of spread, tumor components and vascularity), along with clinical and demographic information, may help in narrowing the differential diagnosis. Computed tomography and magnetic resonance imaging play an important role in this assessment.

Findings and procedure details

The retroperitoneum extends from the diaphragm superiorly to the pelvis inferiorly and is situated between the posterior parietal peritoneum anteriorly and the transversalis fascia posteriorly. The retroperitoneum is broadly divided into the anterior and posterior pararenal, perirenal, and great vessel spaces. The anterior pararenal space is bordered anteriorly by the posterior parietal peritoneum, posteriorly by the anterior renal fascia (Gerota fascia), and laterally by the lateroconal fascia. The anterior pararenal space is subdivided into the pancreaticoduodenal space, which contains the pancreas and duodenum, and the pericolonic space, which contains the ascending and descending colon. The posterior pararenal space is situated between the posterior renal fascia (Zuckerkandl fascia) and the transversalis fascia, whereas the perirenal space is located between the anterior renal fascia and the posterior renal fascia. The great vessel space is the fat-containing region that surrounds the aorta and the inferior vena cava (IVC) and lies anterior to the vertebral bodies and psoas muscles. Below the level of the kidneys, the anterior and posterior pararenal spaces merge to form the infrarenal retroperitoneal
space, which communicates inferiorly with the prevesical space and extraperitoneal compartments of the pelvis. Because of loose connective tissue in the retroperitoneum, tumors can have widespread extension before clinical presentation. Fig. 1.

Fig. 1: Drawing of the anatomy of the retroperitoneal spaces at the level of the kidneys. The anterior pararenal space (APRS) is located between the parietal peritoneum (PP) and the anterior renal fascia (ARF) and contains the pancreas (Pan), the ascending colon (AC), and the descending colon (DC). The posterior pararenal space (PPRS) is located between the posterior renal fascia (PRF) and the transversalis fascia (TF). The perirenal space (PRS) is located between the anterior renal fascia and the posterior renal fascia. Ao = aorta, IVC = inferior vena cava, LCF = lateroconal fascia.

located between the anterior renal fascia and the posterior renal fascia. $Ao = \text{aorta}$, $IVC = \text{inferior vena cava}$, $LCF = \text{lateroconal fascia}$.

The retroperitoneum can host a wide spectrum of pathologies, and we will divide them in fluid collections and infections and solid retroperitoneal processes, and we will review the various pathologies in this groups.

1. **Retroperitoneal Fluid Collections and Infection**

**Inflammations and Abscesses**

Local reactions or abscesses may develop in the retropritoneum as a complication of a retroperitoneal inflammatory disease, trauma, extraperitoneal hollow viscus perforation or superinfection of hematomas and urinomas. Apart from tuberculosis (developing countries), the majority of psoas abscesses (Fig.2) are of pyogenic origin (Staphylococcus aureus and mixed gram-negative organisms). Acute abscesses or inflammations lead to serious illness. Chronic forms present with nonspecific clinical signs and symptoms.

CT findings (Fig. 3,4,5): Inflammatory reactions in the retroperitoneum may be localized by encapsulation, may be confined to fascia-defined spaces, or may involve the entire retroperitoneum. The density increase of an inflammatory collection in the retroperitoneum depends on the protein content and age of the process, resulting in attenuation values that usually range from 10-30HU. The fascial planes are most often thickened and may show enhancement with intravenous contrast. Early stages of abscess formation may not yet show the typical rim enhancement seen in more mature abscesses. Exsudative processes (e.g. phlegmons, pancreatitis) permeate and obscure the retroperitoneal fat, causing general increase in CT density.
Fig. 2: Psoas muscle abscess

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 3: Retroperitoneal abscess and psoas muscle abscess

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 4: Retroperitoneal abscess and psoas muscle abscess

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 5: Retroperitoneal abscess and psoas muscle abscess

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

Hematoma

Retroperitoneal hematoma can result from vertebral or pelvic fractures, injuries of the pancreas or urogenital tract, or vascular injuries. Among these causes, trauma of the kidneys is most frequent. Spontaneous retroperitoneal or pelvic hemorrhage in adults requires exclusion of an aortic rupture. It may also be due to neoplastic diseases, hemorrhagic diathesis, or anticoagulant medication, which is the most frequent cause of spontaneous psoas hematoma.
CT findings: Hematomas appear as masses of varying size whose CT attenuation depends largely on the age and size of the collection. Hemorrhage in acutely bleeding patients may be isoattenuating to soft tissue or to be more precise to the blood in the aorta. Contrast extravasation in to a hemorrhagic area indicates active bleeding. A second portal phase scan may be used to confirm increase in size of the actively bleeding focus. Recurrent hemorrhage can be suspected if there is marked heterogeneity in the hemorrhagic area. Hematomas do not enhance after intravenous contrast administration. A chronic hematoma may be confused with an abscess or necrotic mass, and percutaneous needle aspiration may be necessary for definite diagnosis. Fig. 6,7,8,9.

Fig. 6: Iliopsoas muscle hematoma

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 7: Iliopsoas muscle hematoma

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 8: Subcapsular renal hematoma and retroperitoneal hematoma

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
**Fig. 9:** Subcapsular renal hematoma and retroperitoneal hematoma

**References:** Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

Urinoma
Injuries of the renal collecting system and lower urinary tract (traumatic, iatrogenic) may allow urine to extravasate into the perirenal fat along the ureter or collect at perivascular sites. Weeks of years may pass between the injury and the appearance of clinical symptoms. Infection of the urinoma leads to retroperitoneal abscess formation.

CT is a very sensitive tool for detection of urinoma but requires late scans after the injection of contrast material for detection of persistent urinary leaks.

CT findings: Any indeterminate postoperative fluid collection detected in a perirenal, periureteral, or perivascular location should be imaged on delayed scans (>15min) after contrast administration. Contrast extravasation into the fluid confirms the diagnosis of persistent urinary leak. Chronic urinoma, however, may no longer be accompanied by a contrast extravasation and may require needle aspiration for diagnostic confirmation. Old, liquefied hematomas may be indistinguishable from chronic urinomas by CT morphology alone.

Cysts

Cysts in the retroperitoneum are rare. Congenital cysts may arise from the bowel or urogenital tract but are less common than acquired posttraumatic or postinflammatory cysts, which are usually in direct contact with the side of the primary lesion. Differentiation is required from old hematomas and urinomas and must rely on the clinical presentation in addition to imaging findings.

CT findings: Cysts appear as masses of varying size that have smooth margins, are typically well encapsulated, and are usually of water attenuation. Cysts do not enhance on post contrast scans and do not show rim enhancement. Teratogenic cysts and dermoid cysts include various embryonic elements and may contain calcifications or even teeth. Fig. 10,11,12
Fig. 10: Large cystic mass within the hypogastric, below level of aortoiliac bifurcation

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 11: Large cystic mass within the hypogastric, below level of aortoiliac bifurcation

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
**Fig. 12:** Retroperitoneal mass with cystic component

**References:** Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

**Lymphocele**

Chylous fluid collections most commonly occur after lymphadenectomy for prostatic or testicular cancer and occasionally for upper abdominal tumors. They are also seen in patients after kidney transplantation, where they may cause secondary renal obstruction due to compression effects on the ureter.

CT findings: Lymphoceles appear as round or oval masses of water density along abdominal lymphatic pathways. Heterogeneous areas of near-fat attenuation may also be present. The mass usually has a very thin wall that cannot be distinguished on CT images and does not enhance with contrast medium.
2. **Solid Retroperitoneal Processes**

Retroperitoneal Fibrosis

Retroperitoneal Fibrosis may occur in a primary form, which probably has an autoimmune pathogenesis and is responsive to corticosteroids, or in a secondary symptomatic form, which can result from inflammation, neoplasms, aortic aneurysms, radiotherapy, drug ingestion, or trauma. Both forms lead to fibrotic induration of the retroperitoneum. The fibrotic process may involve blood vessels, the ureters, the kidneys, and the retroperitoneal portions of the bowel and biliary tract. An acute inflammatory stage is distinguished from a chronic fibrosis stage. Retroperitoneal fibrosis is most prevalent in middle age and predominantly affects males. The malignant form of retroperitoneal fibrosis is caused by infiltration of the retroperitoneum by malignant cells. This kind of desmoplastic malignant reaction of the retroperitoneal fat is associated with breast, stomach, colon, and lung cancer, and Hodgkin’s disease, lymphoma and sarcoma.

CT findings: Retroperitoneal fibrosis presents as masses of soft-tissue density enveloping the aorta and vena cava that may be nodular or plaque-like. It is frequently accompanied by proximal ureteral dilatation. The margins of the mass may be sharply defined or indistinct. Aside from medial deviation of the ureters, no displacement or invasion of retroperitoneal structures will be found in most patients. Retroperitoneal fibrosis usually covers the anterior part of the great vessels and extends to the lateral wall of vena cava and aorta. In the primary form, the posterior wall of the aorta is typically preserved. The soft-tissue process tends to progress in a caudocranial direction along the midline. The process commonly begins in the area of the bifurcations of the aorta and inferior vena cava. Differentiation of the malignant form of retroperitoneal fibrosis is often impossible based on morphological CT signs. On noncontrast CT images the attenuation values are similar to those of muscle tissue and the mass is very difficult to distinguish from vessels. Therefore, iv contrast administration is required. Scans in the late arterial or portal phase best demonstrate contrast uptake in acute inflammation while scans in the interstitial phase of contrast enhancement show contrast uptake in areas of fibrosis. Fig. 13,14.
**Fig. 13:** Retroperitoneal fibrosis involving the abdominal aorta

*References:* Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 14: Retroperitoneal fibrosis involving the iliac arteries

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

Pelvic Fibrolipomatosis

Pelvic fibrolipomatosis is a disease of unknown etiology in which increased fatty tissue deposition predominates over fibrous and inflammatory components. Men from 25 to 60 years of age are affected much more often than women.

CT findings: The small fibrous component causes the pelvic mass to display predominantly fat density on CT scans. The mass causes displacement, elevation, and narrowing of pelvic soft-tissue structures but not effective compression. The lipomatous mass may completely fill the pelvis and can expand the presacral space to more than 10mm width.
Primary Retroperitoneal Tumors

Retroperitoneal neoplasms in the retroperitoneum can be broadly divided into four groups: (a) mesodermal neoplasms; (b) neurogenic tumors; (c) germ cell, sex cord, and stromal tumors; and (d) lymphoid and hematologic neoplasms.

- **Mesodermal Neoplasms**

Most of the retroperitoneal neoplasms are of mesodermal origin, with liposarcomas, leiomyosarcomas, and malignant fibrous histiocytomas making up more than 80% of these tumors. Retroperitoneal sarcomas are commonly seen in the 5th and 6th decades of life. These tumors are large at the time of clinical presentation and often involve adjacent structures. Compression of adjacent organs causes formation of a pseudocapsule. The recurrence rates are high, and metastases to liver, lung, bones, and brain may be seen.

**Liposarcoma** - Liposarcoma is the most common primary retroperitoneal sarcoma. Histologically, liposarcoma is classified, in increasing order of malignancy, into four subtypes. The well-differentiated subtype, the most common type of retroperitoneal liposarcoma, is a predominantly hypoattenuating lesion on CT images because of its fat content. The appearance of liposarcoma may be similar to that of a lipoma, but liposarcoma has thicker, irregular, and nodular septa that show enhancement after contrast material administration (Fig. 15,16). Furthermore, lipoma is less common than liposarcoma in the retroperitoneum.
Fig. 15: Liposarcoma of the left pararenal anterior space

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
**Fig. 16:** Liposarcoma of the left pararrenal anterior space

**References:** Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

**Leiomyosarcoma** - Leiomyosarcoma is the second most common (28%) primary retroperitoneal sarcoma. Leiomyosarcoma arises from retroperitoneal smooth muscle tissue, blood vessels, or wolffian duct remnants and can grow to a large size (>10 cm) before compromising adjacent organs and precipitating clinical symptoms such as venous thrombosis. At CT, small tumors may be homogeneously solid, but large tumors have extensive areas of necrosis and occasional hemorrhage. The presence of extensive necrosis in a retroperitoneal mass, with contiguous involvement of a vessel, is highly suggestive of leiomyosarcoma.

**Malignant Fibrous Histiocytoma** - Malignant fibrous histiocytoma is the third most common retroperitoneal sarcoma (19%) and overall is the most common soft-tissue sarcoma in the body. This tumor is more common in males (3:1), particularly in the 50-60-year age group. CT imaging appearances are nonspecific and demonstrate a large,
infiltrating, and heterogeneously enhancing soft-tissue mass with areas of necrosis and hemorrhage and with invasion of adjacent organs. The presence of calcification may help to distinguish malignant fibrous histiocytoma from leiomyosarcoma.

**Lipoma** - It is the commonest benign mesenchymal tumor, showing a peak incidence in the fifth and sixth decades. The tumor may have a superficial (subcutaneous) or deep site of occurrence (retroperitoneum, chest wall, hands, feet). Fewer than 10% of lipomas are multifocal. On CT lipoma appears as a well-circumscribed, homogeneous mass of fat density. Unlike liposarcoma, the mass does not contain soft-tissue components and does not enhance with intravenous contrast. Intramuscular lipoma very rarely shows locally invasive growth with separation of the surrounding muscle planes (invasive lipoma).

- **Neurogenic Tumors**

Neurogenic tumors constitute 10-20% of primary retroperitoneal tumors. Compared with the mesenchymal tumors, neurogenic tumors occur in a younger age group and are more likely to be benign and have a better prognosis.

**Neuroblastoma** - It is a malignant tumor and is the commonest retroperitoneal tumor in children. Two-thirds of neuroblastomas are located in the adrenal gland. At CT neuroblastoma is irregular, lobulated, and heterogeneous and demonstrates coarse amorphous calcifications and variable contrast enhancement, as well as invasion of adjacent organs and encasement of vessels with luminal compression.

- **Germ Cell, Sex Cord and Stromal Cell Tumors**

**Teratoma** - Less than 10% of teratomas are found in the retroperitoneum. Teratomas accounts for as many as 11% of primary retroperitoneal tumors. It is more common in females, with a bimodal age distribution (<6 months and early adulthood). Teratoma can be benign or malignant, and benign teratoma can be either mature or immature. Fig. 17, 18, 19.

The diverse tissue components of teratomas may give them a nonhomogeneous CT appearance. The coexistence of fat, soft-tissue elements, bone, or teeth, within a mass is considered pathognomonic. Malignant teratomas may invade the inferior vena cava and may remain relatively homogeneous, and thus have a nonspecific appearance on CT.
**Fig. 17:** Malignant teratoma of the sacrococcygeal region

**References:** Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Fig. 18: Malignant teratoma of the sacrococcygeal region

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT
Lymphoid and Hematologic Neoplasms

Lymphoma - It is the most common retroperitoneal malignancy, accounting for 33% of all these cases. Hodgkin lymphoma manifests with limited disease, often involving the mediastinum and spleen. Non-Hodgkin lymphoma manifests with extranodal disease in the liver, spleen, or bowel, often at an advanced stage. Paraaortic lymph nodes are involved in 25% of the patients with Hodgkin lymphoma and 55% of the patients with non-Hodgkin lymphoma. Approximately 14% of the patients with non-Hodgkin lymphoma present with a retroperitoneal mass. Mesenteric lymph nodes are also more commonly involved in non-Hodgkin lymphoma.

At CT, lymphoma is seen as a well-defined homogeneous mass, with mild homogeneous contrast enhancement, that spreads between normal structures without compressing
them. The aorta and IVC can be anteriorly displaced, producing the "floating aorta" or "CT angiogram" sign.

Fig. 20: Retroperitoneal lymphangioma

References: Radiologia, Hospital do Divino Espírito Santo de Ponta Delgada, Hospital do Divino Espírito Santo de Ponta Delgada - Ponta Delgada/PT

Secondary Retroperitoneal Masses and Lymphadenopathy

Secondary retroperitoneal masses result from tumor invasion or tumor seeding into the retroperitoneum. The retroperitoneal lymph nodes may be involved by systemic lymphatic diseases (Hodgkin’s disease, non-Hodgkin’s lymphoma) or by tumors of the pancreas, kidneys, stomach, or lesser pelvis (testes, ovaries, uterus, bladder, and prostate). Inflammatory processes can also cause changes in the retroperitoneal lymph nodes.

CT is the method of choice for the detection of retroperitoneal lymph nodes but its accuracy to detect abnormality in normal-sized lymph nodes is limited.
CT findings: Tumor invasion into the retroperitoneum is seen in large tumors, especially of the kidneys, adrenals, pancreas, and retroperitoneal bowel structures. Usually the primary tumor site is well-delineated and differentiation from primary retroperitoneal tumors poses no problem. The diagnosis of lymphadenopathy at CT is mainly based on the size criterion, the minimum diameter on axial sections.

Conclusion

Familiarity with imaging features of various retroperitoneal masses, combining with the clinical and laboratorial findings, is very important in patient assessment, facilitate accurate diagnosis, therefore allowing a suitable decision of treatment for the patient, in order of the best prognosis possible.

Personal information

References


