The Peritoneal Cavity, Retroperitoneum, and Abdominal Wall

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1 Introduction

The abdominal region is the large part of the body extending from the diaphragm to the pelvis. It includes the abdominal and pelvic cavities, bound by bone and muscle. The peritoneum is the largest and most complexly arranged serous membrane in the body. It forms the lining of the peritoneal cavity, which extends in abdominal cavity and contains the gastrointestinal tract; major abdominal organs, such as the liver, spleen, pancreas, urinary bladder, ovaries, and uterus; and many nerves, vessels, and lymph nodes. The peritoneum extends caudally in the pelvic cavity in males and females (as vaginal tunic and vaginal process, respectively). It is a serous membrane, divided into the parietal peritoneum, which covers the inner surface of the abdominal wall (the abdominal fascia) and the pelvic and scrotal cavities; the visceral peritoneum, which covers the abdominal, pelvic, and scrotal organs; and the connecting peritoneum, which extends between organs or between an organ and the parietal peritoneum, forming peritoneal folders that are divided into mesenteries, omenta, and ligaments. The purpose of the peritoneum is to provide a frictionless surface over which the viscera can move. It also serves as a site of fluid transport. A capillary film of serous fluid separates the parietal and visceral layers of the peritoneum from one another and lubricates the peritoneal surfaces. The retroperitoneal region extends dorsal to the peritoneal and pelvic cavities from the diaphragm to the pelvic inlet. It is bordered dorsally by the vertebrae and paraspinal muscles and laterally by the muscular abdominal and pelvic walls. The kidneys, ureters, and adrenal glands are considered to be retroperitoneal organs. The descending aorta, caudal vena cava, lumbar lymph nodes, cisterna chili, lymphatics, fat, and much of the abdominal wall musculature are also are also located in the

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retroperitoneum. The retroperitoneal cavity communicates cranially with the dorsocaudal mediastinum and caudally with the pelvic canal. Familiarity with these connections is important because diseases can spread easily among different body regions. MDCT studies performed with isotropic imaging and dorsal and sagittal reformation can fully delineate the peritoneal and retroperitoneal spaces and extent of diseases.

2   MDCT Imaging Strategies

The peritoneal and retroperitoneal spaces are normally included in abdominal MDCT examination. The scan range for such examination generally includes the diaphragmatic crura cranially and the pelvic outlet caudally, but not the perineal and scrotal regions. These regions must be included in examinations in cases of specific clinical indications (e.g., pelvic mass) or for comprehensive evaluation of the retroperitoneal space.

On MDCT, normal peritoneum appears as a fine, thin, and thus barely detectable structure. In humans, contrast-enhanced MDCT is the primary imaging modality for the assessment of peritoneal pathology. Early detection of peritoneal changes is essential for the management of several neoplastic and non-neoplastic conditions in veterinary patients. Contrast-enhanced MDCT scans with near-isotropic or isotropic resolution are necessary for fine evaluation of the abdominal cavity in dogs and cats. Most peritoneal and retroperitoneal pathological processes originate in the peritoneal and retroperitoneal organs. Therefore, a multiphasic approach (including the arterial phase and portal venous phase) provides adequate results in most instances. Performance of a third delayed series may be helpful for interpretation of pelvic pathological processes (e.g., prostatic, rectal, and vaginal diseases).

3   Disorders of the Peritoneum and Retroperitoneum

3.1   Inflammatory Peritoneal Disorders

Peritonitis is the inflammation of the peritoneal cavity. It may be primary or secondary and generalized (i.e., diffuse) or localized (i.e., involving a small portion of the peritoneum). Primary septic peritonitis may occur as the result of the hematogenous spread of microorganisms; the most common example is feline infectious peritonitis caused by coronavirus infection (Fig. 1). Secondary septic peritonitis in dogs and cats results from gastrointestinal rupture (perforation, rupture, and surgical dehiscence), intraabdominal (hepatic, pancreatic, splenic, and prostatic) abscess, pyometra rupture, and penetrating injury. Noninfectious secondary chemical peritonitis can be caused by contact of irritants with the peritoneum in

Fig. 1 Feline infectious peritonitis. (**a**) Dorsal MPR view of the abdomen in a cat. Note the large amount of free peritoneal fluid (13 HU). (**b**) *Arrow* indicates omental thickening and coarctation. Note the gastrointestinal wall edema
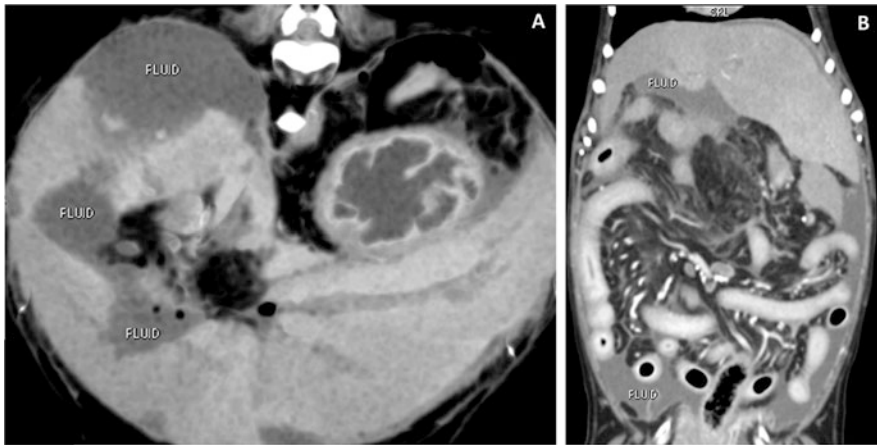

Fig. 2 Postoperative biliary peritonitis in a dog. (**a**) Transverse MinIP view of the liver showing bile collection (bilomas), a complication of recent biliary surgery. (**b**) Dorsal MPR view of the abdomen in the same dog, showing omental thickening in the cranial-middle abdomen and diffuse abdominal fluid

cases of urinary tract disruption (sterile uroabdomen); bile leakage caused by gallbladder rupture, hepatic torsion, or hepatobiliary surgical complication (bile peritonitis); and pancreatic disruption with leakage of exocrine pancreatic secretions (sterile bile peritonitis) (Figs. 2, 3, and 4).

Pathological involvement causes thickening of the peritoneal layers, which become easily noticeable. However, several acute and chronic peritoneal diseases have overlapping clinical and imaging features. In humans, three major patterns of
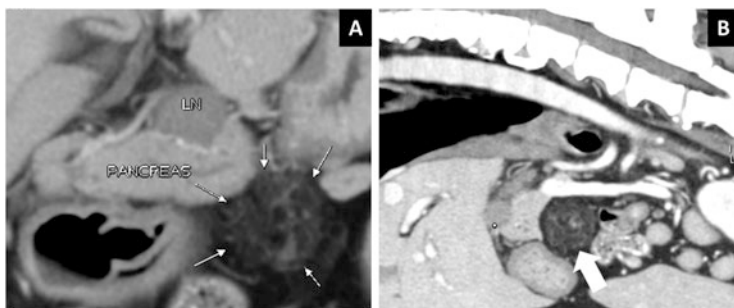
Fig. 3 Focal peritonitis in a dog with a history of recurrent pancreatitis. (**a**) Transverse view showing focal peripancreatic peritoneal thickening (*arrows*). Note the enlarged pancreatic lymph node (LN). (**b**) Sagittal view of the same dog showing focal increased peritoneal opacity and thickening (*arrow*)
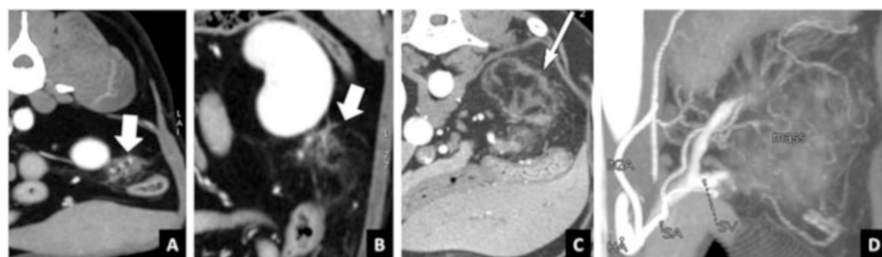

Fig. 4 Postoperative peritonitis. (**a**, **b**) Transverse views of a female dog obtained 3 weeks after ovariectomy. *Arrow* indicates focal thickening of the peritoneum at the site of the left ovary (focal peritonitis). (**c**, **d**) Transverse and dorsal MIP views of a dog obtained after splenectomy for splenic torsion. Note the omental thickening and infarction at the site of surgery

peritoneal thickening are possible: smooth regular (uniform thickness, smooth interface with omental fat), irregular (nonuniform thickening of focal segments, irregular interface with omental fat), and nodular (well-defined nodules of variable diameter with soft tissue attenuation). Although inflammatory and neoplastic conditions may have similar CT appearances, the patient's clinical history and the analysis of the CT peritoneal pattern together with associated ancillary findings aid interpretation and differential diagnosis. Smooth uniform thickening is the prevalent pattern in most cases of acute peritonitis. Granulomatous peritonitis can show a diffuse nodular pattern that may mimic a malignant condition (Fig. 5). Peritoneal/omental necrosis and steatites may form mass-like lesions, which could be confounded with malignancy (Figs. 6 and 7). These MDCT features, described in humans, are similar to those we find routinely in dogs and cats, and they have been reported on in recent veterinary studies.

Sclerosing encapsulating peritonitis is a condition of unknown etiology that causes intestinal obstruction, described rarely in dogs and cats. As described in humans, the canine and feline abdominal organs are encased in a thick
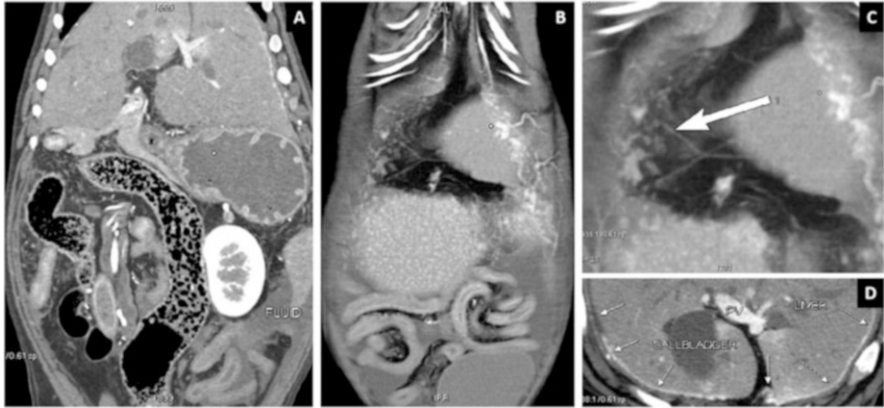
Fig. 5 Granulomatous peritonitis in a young Bernese dog. (**a**) Dorsal MPR view showing diffuse increased peritoneal/omental opacity. (**b**) Dorsal thin-average view through the ventral abdomen, showing peritoneal nodules that mimic a neoplastic condition. (**c**) Close-up view of (**b**), showing the peritoneal nodular pattern (*arrow*). (**d**) Transverse view from the same dog, showing thickening and enhancement of the parietal peritoneum
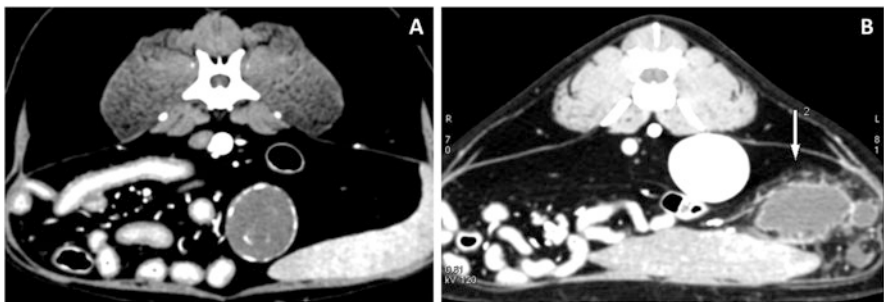

Fig. 6 (**a**) Peritoneal fat necrosis. Transverse view of the abdomen in a dog showing a well-defined, ovoid, non-enhancing mass with mineralized borders. (**b**) Transverse view of a cat showing a mass in the left middle peritoneal cavity that is hypoattenuating with great peripheral enhancement (*arrow*). Other smaller lesions (omental steatitis) are present in the same region

fibrocollagenous membrane in patients with this condition. Signs of gastrointestinal obstruction, distortion, and fixation, and peritoneal or mural calcification, may be seen (Fig. 8).

3.2 Neoplastic Peritoneal Diseases

Mesotheliomas originate from the cells covering the serosal cavities (pleura, pericardium, peritoneum, and tunica vaginalis). They are very uncommon in animals,
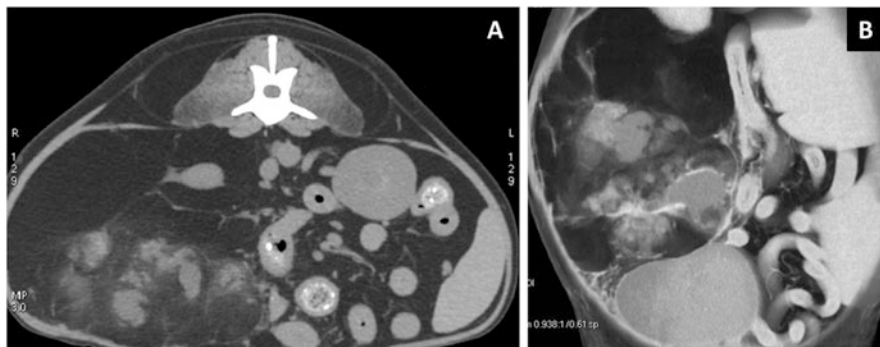
Fig. 7 Necrotic omental lipoma forming mass-like lesions in a dog. (**a**) Transverse view. (**b**) Dorsal MPR view showing the omental masses, which compress the surrounding peritoneal organs
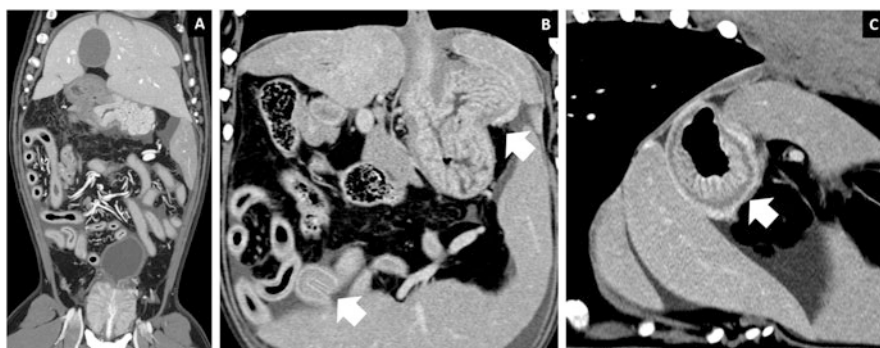
Fig. 8 Sclerosing peritonitis in a Labrador retriever. (**a**) Dorsal MPR view showing diffuse peritoneal/omental thickening. (**b**) Dorsal view in the same dog. Note the signs of gastrointestinal distortion and incarceration (*arrows*). (**c**) Parasagittal image showing a thick fibrocollagenous membrane encasing the stomach (*arrow*)

representing just 0.2% of all canine tumors. Mesotheliomas are usually malignant and may involve one or all cavities.

Peritoneal mesothelioma appears on MDCT images as irregular peritoneal thickening with the diffuse nodular pattern or coalescent, mass-like soft tissue within the omentum (omental caking), which enhances in post-contrast series (Fig. 9). MDCT is useful for the detection, characterization, and staging of, and biopsy guidance for, peritoneal nodules and masses. Peritoneal effusion is present in most cases. The amount of ascites is quite variable, ranging from massive, diffuse ascites to focal, small, loculated collections of fluid. Concomitant pleural mesothelioma, with or without pleural effusion, is possible. Mesothelioma may extend to the visceral peritoneal surfaces of the small bowel, encasing it. As a result, the small bowel is compacted and located in the center of the abdomen.

Malignant peritoneal mesothelioma is indistinguishable from carcinomatosis when the predominant imaging findings are multifocal peritoneal nodules and

Fig. 9 (**a**) Peritoneal mesothelioma in a 9-year-old boxer. Note the large amount of free fluid in the peritoneal cavity. The small bowel is compacted and located in the center of the abdomen. *Arrows* indicate peritoneal nodules. (**b**, **c**) Transverse and sagittal thin-MIP views from another dog, showing free abdominal fluid, peritoneal thickening, and small bowel compaction. In (**c**), note the diffuse increased omental opacity and thickening (*arrow*)
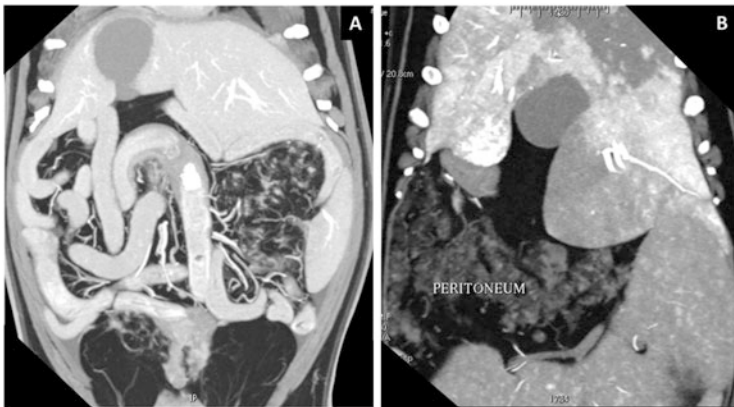
Fig. 10 Carcinomatosis in two different dogs. (**a**) Dorsal MPR view showing diffuse thickening of the omentum with the reticulonodular pattern in a dog with intestinal carcinoma. (**b**) Peritoneal thickening with nodular/micronodular lesions, which spare some peritoneal areas. Note the concomitant diffuse HPD

omental caking (Figs. 10 and 11). Ascites, peritoneal nodules and thickening, and omental nodules and masses are also the most common MDCT features of peritoneal carcinomatosis. Carcinomatosis refers to metastatic peritoneal diseases, especially those arising from carcinomas of the gastrointestinal tract and pancreas.
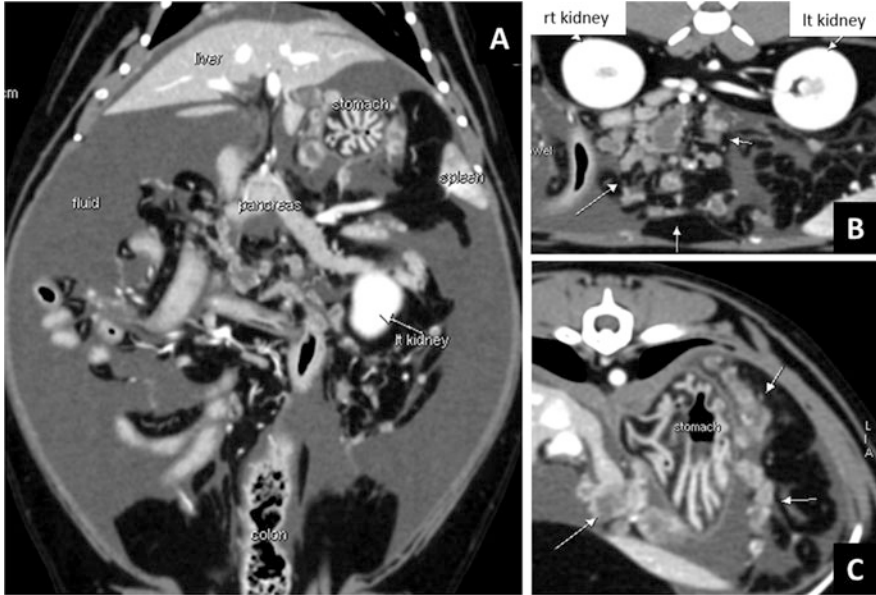
Fig. 11 Carcinomatosis in a cat. (**a**) Dorsal MPR view in a cat that had previously undergone enterectomy for intestinal carcinoma. Abundant free peritoneal fluid is present. The omentum is thickened and shows nodular aspects, which are better visible in **b** and **c** (*arrows*)

Intraperitoneal dissemination of tumor cells occurs by several mechanisms: intraperitoneal seeding, direct invasion, hematogenous dissemination, and lymphatic dissemination. Rupture of an abdominal hemangiosarcoma can cause widespread peritoneal seepage of blood with local implantation (Fig. 12).

## 3.3 Retroperitoneal Diseases

MDCT is an excellent tool for the evaluation of the retroperitoneal space. Fluid accumulation and masses in the retroperitoneal space are frequent indications for MDCT examination. Retroperitoneal fluid can occur in many benign and malignant conditions. In veterinary patients, most common retroperitoneal pathologies are caused by penetrating injuries, leading to hypaxial muscular hemorrhage, ureter rupture (see also the "The Body Trauma" chapter), or foreign body migration with abscess formation or phlegmon (Figs. 13 and 14).

Retroperitoneal tumors may be primary or secondary. Primary retroperitoneal masses originate in the retroperitoneum but outside of the major retroperitoneal organs. They derive from tissues contained in the retroperitoneal space (adipose, muscle, vessel, and nerve tissue), from embryonic remnants or heterotopies, from one or more embryonic layers (ectoderm, mesoderm, and/or endoderm), or from
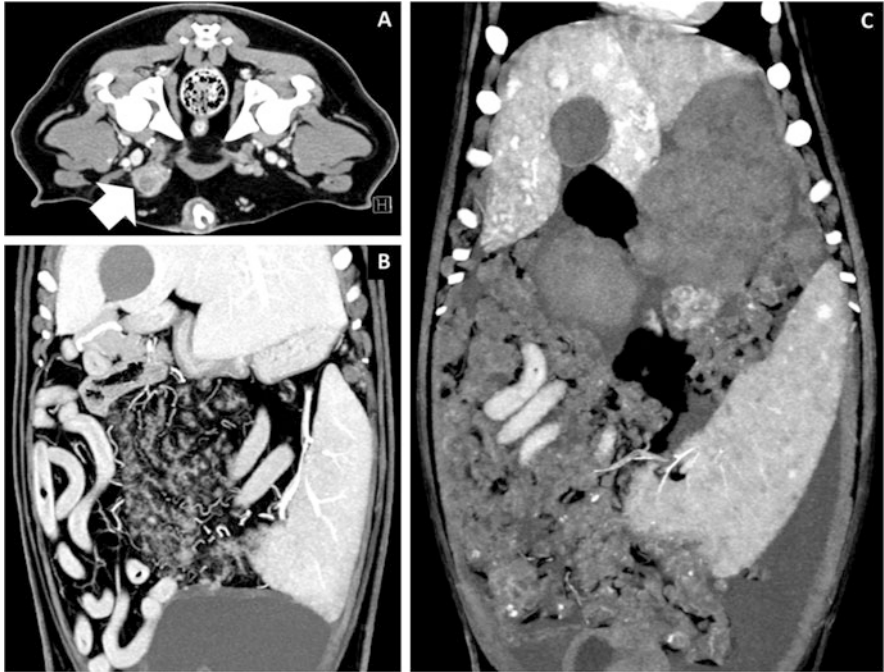
Fig. 12 (**a**) Transverse view of the pelvis in a dog with funicular infiltration (*arrow*) from testicular seminoma, which had recently been removed. (**b**) Dorsal MPR view from the same dog shows intraperitoneal seeding. (**c**) Dorsal MPR view of another dog with ruptured splenic hemangiosarcoma and peritoneal implantation
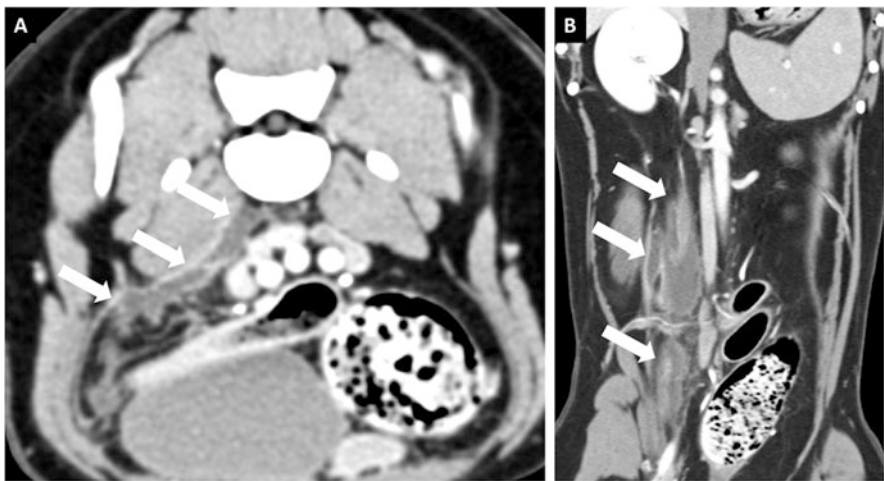
Fig. 13 Retroperitoneal phlegmon. (**a**, **b**) Transverse and dorsal MPR views of a dog with retroperitoneal unilateral effusion due to foreign body (not visible here) migration
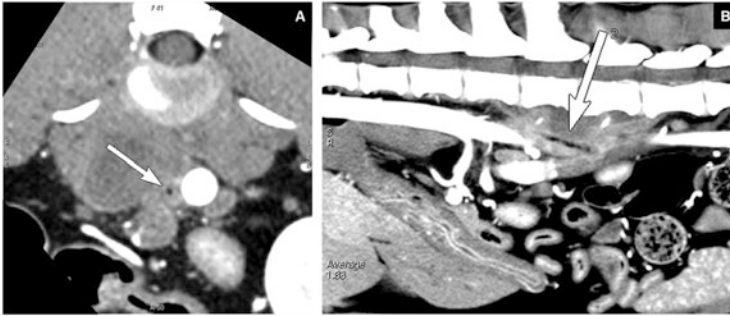
Fig. 14 Retroperitoneal abscess of the hypaxial muscles. (**a**) Transverse view showing muscular thickening and moderate hypoattenuation. Note the small air-containing lesion (*arrow*), better visible in the parasagittal view (**b**), consistent with a non-radiopaque (vegetal) foreign body
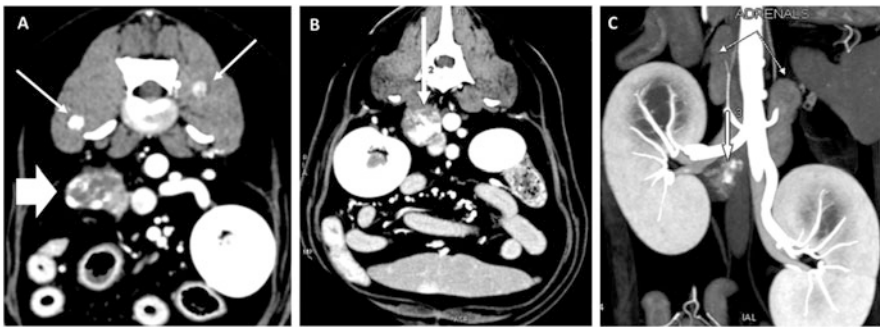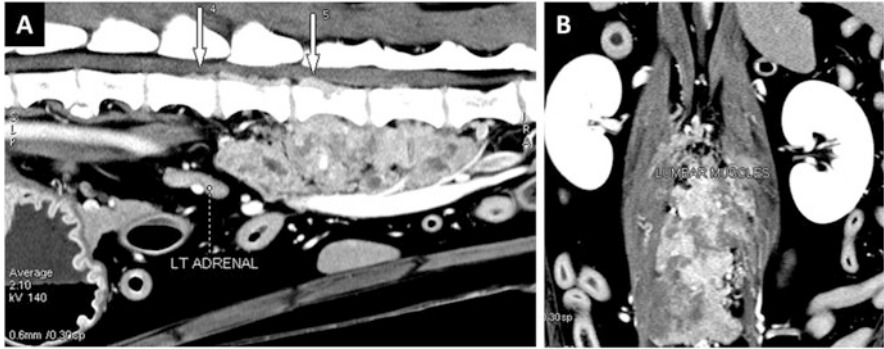

Fig. 15 Primary retroperitoneal neoplasia. (**a**) Transverse view from a dog with small retroperitoneal hemangiosarcoma (*large arrow*) and muscular metastasis (*arrows*). (**b**, **c**) Transverse and dorsal views from another dog with retroperitoneal aortic paraganglioma (*arrow*)

totipotent embryonic germs. In veterinary patients, retroperitoneal hemangiosarcoma is probably the most common primary retroperitoneal malignancy, and it is often associated with hemoretroperitoneum (Fig. 15a). Other primary retroperitoneal tumors described in dogs are extra-adrenal paraganglioma (aortic body tumor), extraskeletal mesenchymal chondrosarcoma, osteosarcoma, and teratoma (Figs. 15b, c and 16).

Secondary retroperitoneal tumors include tumors of the retroperitoneal organs (primary and metastatic adrenal, renal, and collecting system tumors), retroperitoneal lymph node metastasis (e.g., lumbar lymph node metastasis of testicular or anal sac cancer), and infiltrative neoplasias (e.g., lymphoma) (Figs. 17, 18, and 19).

Retroperitoneal hemorrhage commonly occurs with ruptured malignant masses (e.g., adrenal masses, sarcomas) (Fig. 20).
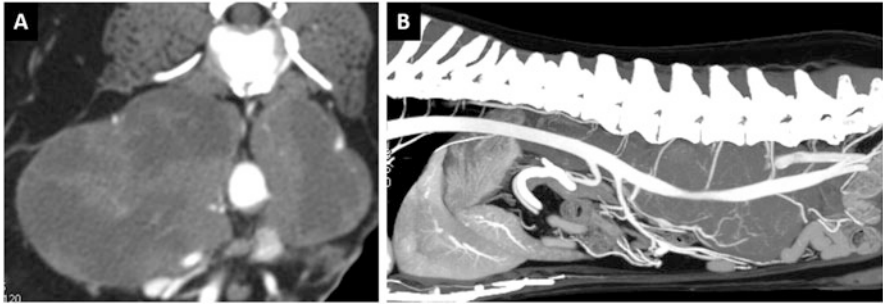
Fig. 16 Primary retroperitoneal neoplasia (neuroendocrine tumor). (**a**) Sagittal (thin-average) view of a dog with lumbar pain and paraparesis. Note the large and complex hypervascular retroperitoneal mass and enlarged vertebral sinuses (*arrows*). (**b**) Dorsal MPR view of the same dog, showing the mass extension and relationships to the hypaxial musculature
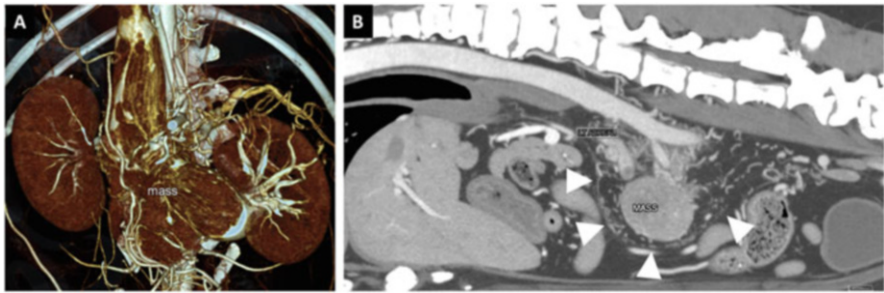

Fig. 17 Secondary retroperitoneal neoplasia. (**a**) VR of the retroperitoneal region in a dog, showing a huge left adrenal mass invading the caudal vena cava and renal veins. (**b**) Sagittal MPR view of the same dog, showing the adrenal mass in the retroperitoneal region surrounded by multiple vascular collaterals. Note the distinction between the retroperitoneal and peritoneal cavities (*arrowheads*)
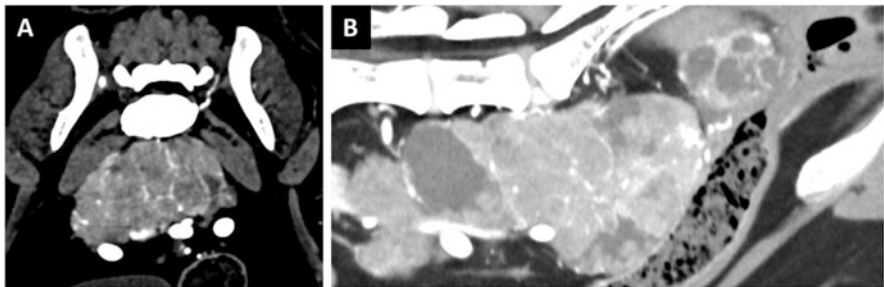
Fig. 18 Secondary retroperitoneal neoplasia. Lymph node metastasis (median sacral and iliac lymph nodes) of anal sac carcinoma in a dog. (**a**) Transverse view. (**b**) Sagittal view

Fig. 19 Secondary retroperitoneal neoplasia. Lumbar lymph-node metastasis of seminoma in a dog. (**a**) Transverse view. (**b**) Thin-MIP sagittal view. Note the ventral displacement of the aorta and stretched lumbar arteries
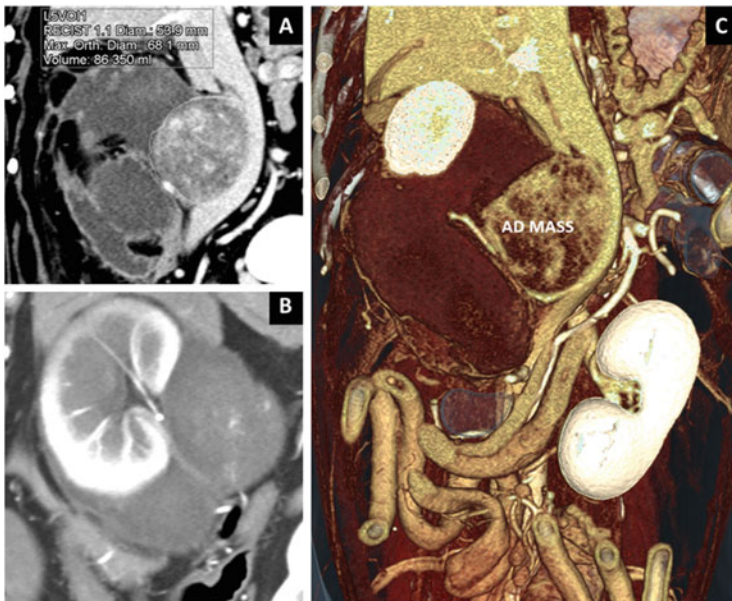
Fig. 20 Retroperitoneal hemorrhage due to large adrenal mass rupture in a dog. (**a**) Non-contrast image showing the large right adrenal mass, which compresses and deviates the caudal vena cava (not invaded). Note the retroperitoneal fluid collection surrounding the mass. (**b**) The hematoma encases the renal vasculature. (**c**) Volume-rendered image showing the right adrenal mass and large retroperitoneal hematoma

3.4 Large Abdominal Masses

The veterinary literature contains no studies on large and huge abdominal masses or the interpretation of MDCT images of such masses. However, MDCT is often required to characterize these masses and establish eligibility criteria for

resectability. Large abdominal masses may involve the abdominal wall and peritoneal or retroperitoneal cavity.

Cranially, the abdominal wall is composed of osseocartilaginous structures, including the sternum, ribs, and costal cartilages. Muscles and fascial layers compose the ventral and lateral abdominal walls. They support and protect the intraperitoneal content and extend to the retroperitoneal space. Masses of the abdominal wall may be subcutaneous or involve one or more deep structures.

Nonneoplastic and neoplastic conditions may affect the abdominal wall, and both types can require MDCT assessment. Nonneoplastic abdominal wall lesions include abscesses, phlegmonous lesions, and abdominal wall hernias (see below in this chapter). Tumor lesions include various benign (e.g., lipoma) and malignant (e.g., sarcoma) conditions.

MDCT is required for the assessment and staging of cutaneous and subcutaneous neoplastic lesions and for the presurgical assessment of large superficial masses. MDCT allows assessment of the boundaries of a mass, its vascularization, and possible deep tissue involvement. Patients with large lipomas and sarcomas are commonly evaluated using MDCT. Large masses involving osseocartilaginous structures or deep tissues of the abdominal wall require comprehensive MDCT evaluation to determine their characteristics before selecting a therapeutic approach (Figs. 21 and 22a).

Regarding cavitary abdominal masses, large peritoneal and retroperitoneal lipomas may be easily identified based on their CT characteristics (negative Hounsfield
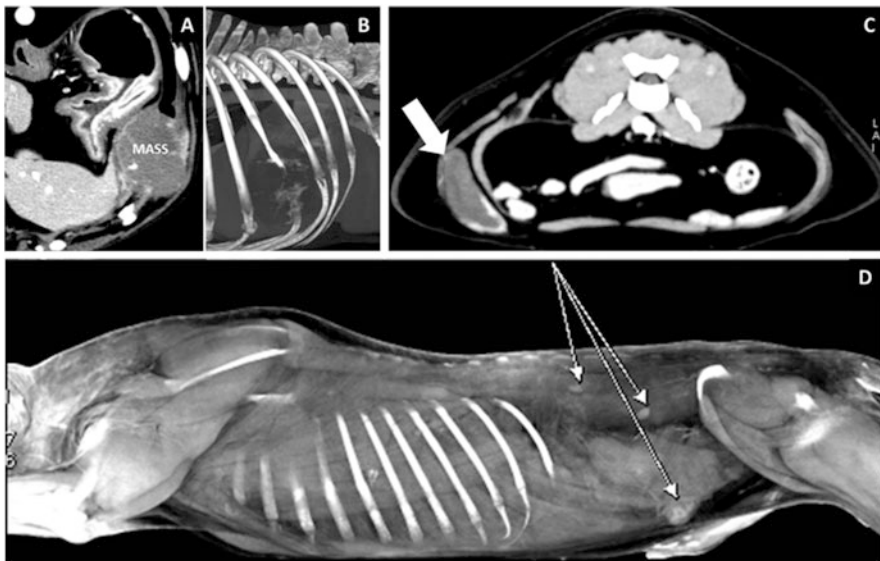
Fig. 21 (**a**, **b**) Transverse and 3D images of a dog with abdominal wall sarcoma (mass) involving the ninth rib (costochondral junction). (**c**) Transverse view from a cat with an abdominal wall mass (mastocytoma, *arrow*). (**d**) Volume-rendered image from a dog showing abdominal wall metastasis (*arrows*) of splenic hemangiosarcoma (not visible here)
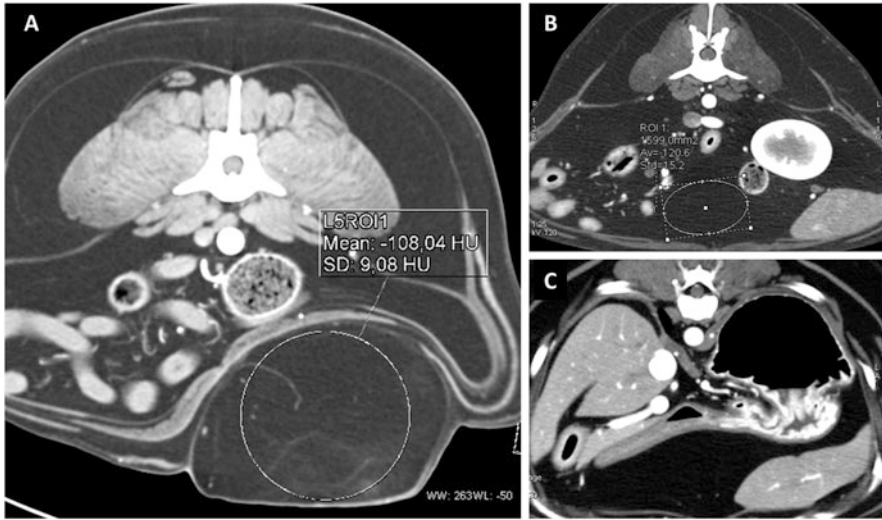
Fig. 22 (**a**) Large subcutaneous abdominal lipoma in a dog (−108 HU). (**b**, **c**) Pre- and post-contrast transverse views of the abdomen in a dog with peritoneal lipomatosis (−120.6 HU), which displaces the abdominal organs
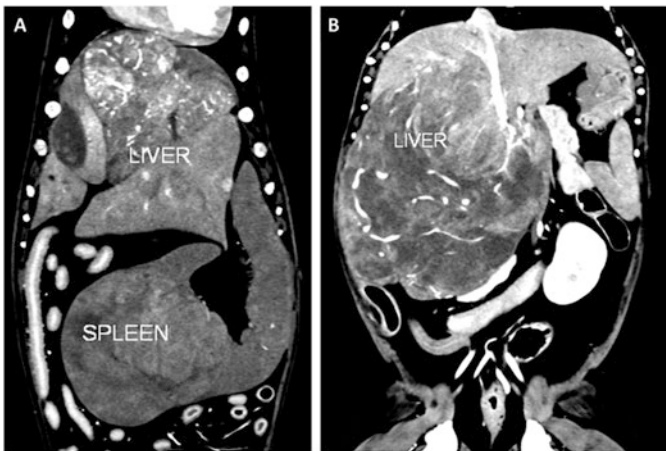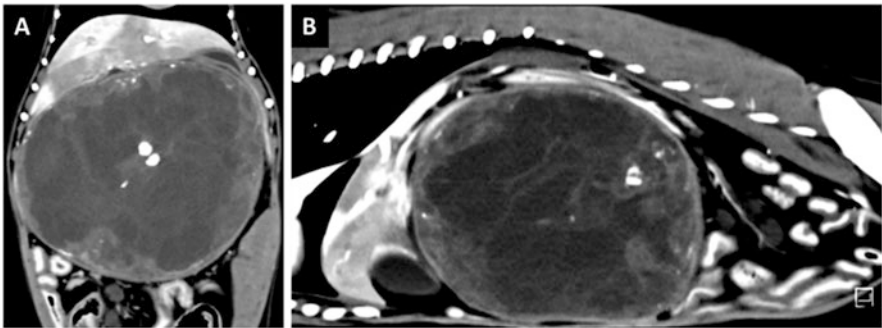

Fig. 23 Large abdominal masses (peritoneal cavity). (**a**) Large splenic and hepatic masses (hemangiosarcoma). In this case, the masses are completely inside the organ of origin and the interpretation is simple. (**b**) Large hepatic sarcoma. The mass is not completely inside the liver, but is clearly connected to it

Unit [HU] values) (Fig. 22b, c). The identification of the organ of origin of large masses can be easy when the mass is completely inside or clearly connected to it (Fig. 23). However, huge masses may occupy the majority of the abdominal cavity and show relationships with various organs. The role of MDCT in the assessment of

masses possibly requiring resection is to demonstrate the organ of origin (if any); establish whether the tumor extends beyond that organ, invading/infiltrating adjacent organs or tissues; identify any vascular encasement/invasion and the affected vessel; and identify any evidence of local or distant metastasis (Fig. 24). In addition, it demonstrates any important anatomical displacement that may be problematic during surgery.

The first step of MDCT assessment is to determine whether the mass is located in the peritoneal or retroperitoneal space. Assessment of the displacement of normal anatomic structures is useful. Dorsal or lateral displacement of retroperitoneal organs, such as the kidney and ureters, may suggest a peritoneal origin. In contrast, ventral displacement of retroperitoneal organs and ventral displacement or encasement of major vessels (aorta, caudal vena cava) or their branches strongly suggests that the tumor has arisen in the retroperitoneum (Figs. 25 and 26). CT signs of large abdominal masses described in humans may be helpful for the assessment of such

Fig. 24 Huge abdominal mass in a Dobermann Pinscherinscher. The mass occupies the majority of the abdominal cavity and has relationships to various peritoneal organs but shows no vascular or tissue connection with other peritoneal organs. The mass was surgically removed and the histopathological results indicated chronic, capsulated granulomatous peritonitis. (**a**) Dorsal view. (**b**) Sagittal view
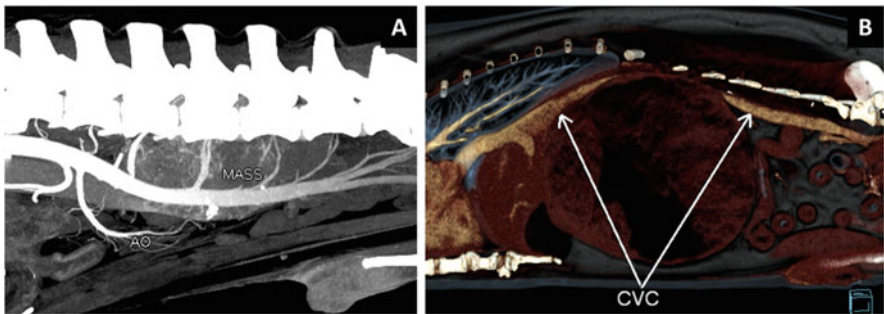
Fig. 25 (**a**) Abdominal masses located in the retroperitoneum may displace the vasculature ventrally. (**b**) Large peritoneal masses compress the vessels dorsally
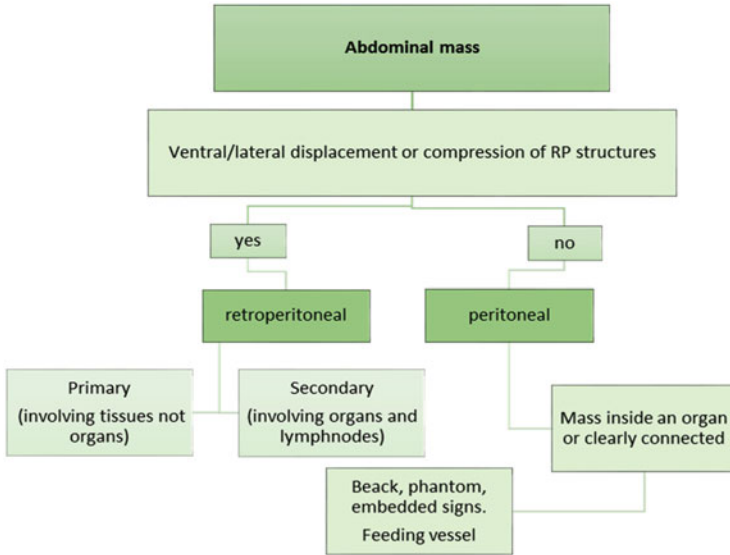
Fig. 26 Flowchart for abdominal mass identification (see the text for further details)
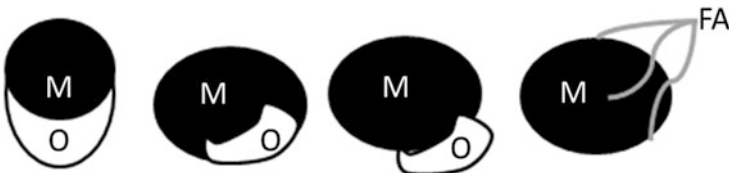

Fig. 27 CT signs indicating the possible origin of an abdominal mass. From *left to right*: beak sign, phantom sign, embedded sign, and feeding artery sign. *M* mass, *O* organ, *FA* feeding artery

masses in veterinary patients as well. These are the "beak sign," in which the mass causes the edge of an adjacent organ to become beak shaped, meaning that it arises from that organ; the "phantom organ sign," in which a small organ with a huge mass arising from it becomes undetectable; the "embedded organ sign," in which part of a hollow organ appears to be embedded in the tumor; and the "prominent feeding artery sign," which is particularly useful for the assessment of hypervascular lesions supplied by arteries that are sufficiently prominent to be visualized on CT (Figs. 27, 28, and 29).
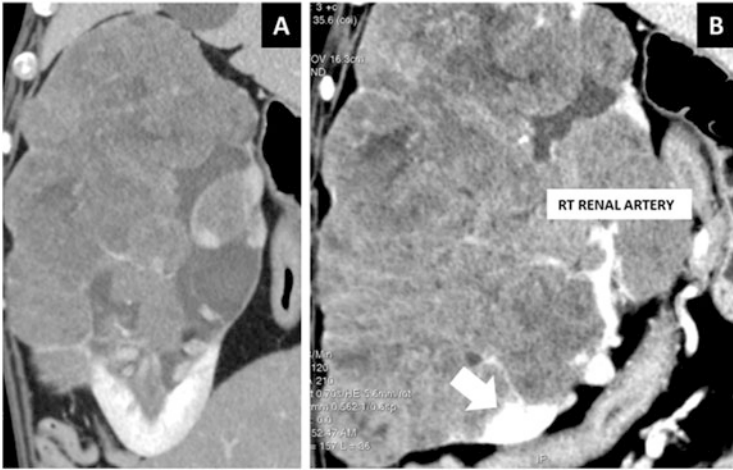
Fig. 28 (**a**) Large renal mass in a dog. Note the beak-shaped margins of the renal tissue, meaning that the mass arises from that organ. (**b**) Huge abdominal mass in another dog. The *arrow* indicates part of the normal renal tissue embedded in the tumoral tissue. The mass (renal carcinoma) also encases and invades the right renal artery
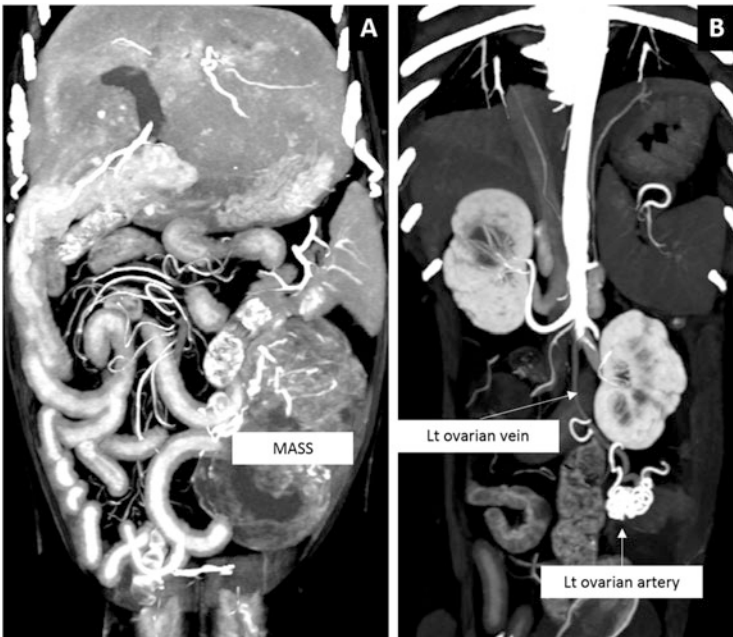
Fig. 29 Feeding artery (ovarian carcinoma). (**a**) Large left-sided abdominal mass in a female mongrel dog. (**b**) The mass is supplied by the left ovarian artery (in the arterial phase, the left ovarian vein is still not enhanced; see the text for supplementary explanation)

3.5 Abdominal Hernias

Abdominal hernias are protrusions of intra-abdominal contents through defects in the diaphragm or abdominal wall. Abdominal hernia types in small animals include diaphragmatic (hiatal hernia [HH], pleuroperitoneal, and peritoneopericardial), umbilical, and inguinal hernias. Internal abdominal hernias are reported rarely, but their occurrence is probably underestimated. Perineal hernias are encountered commonly in MDCT examinations performed to evaluate pelvic trauma or masses.

Diaphragmatic hernias include HH and pleuroperitoneal and peritoneopericardial hernias. HH is a congenital condition in which organs of the abdominal cavity herniate through the esophageal hiatus into the thoracic cavity (see the chapter entitled "The Mediastinum and Neck"). Pleuroperitoneal hernia is a defect in the dorsolateral diaphragm with the herniation of abdominal viscera into the thoracic cavity. Acquired pleuroperitoneal hernias are commonly observed after blunt trauma in dogs and cats. Such hernias associated with congenital conditions are rarely reported on because affected animals die shortly after birth.

Peritoneopericardial diaphragmatic hernia (PPDH) is the most frequently reported congenital pericardial anomaly in dogs and cats. PPDH occurs with improper development of the transverse septum (and rarely due to trauma in early life) and refers to persistent communication between the pericardial and peritoneal cavities, allowing abdominal contents to enter the pericardial cavity, while the pleural space remains intact (Fig. 30). The liver and gallbladder are herniated most frequently, followed by the small intestines, spleen, and stomach. PPDH may be diagnosed using first-level imaging techniques. However, MDCT can have a determinant role in the assessment of concomitant thoracic and abdominal congenital defects and embryonic variants in these subjects, which may change the therapeutic approach and prognosis.

Abdominal wall hernias include umbilical and inguinal hernias. Umbilical hernia is probably the most common type of hernia in dogs. It is commonly diagnosed clinically in puppies and seen incidentally on MDCT images acquired
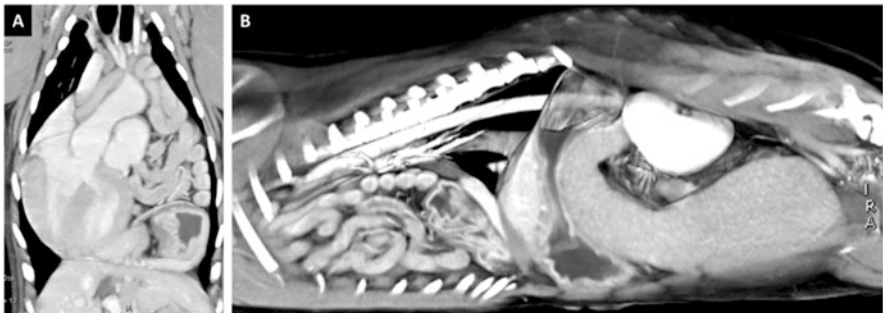
Fig. 30 Peritoneopericardial diaphragmatic hernia in a puppy with concomitant complex cardiac anomaly (not shown here). (**a**, **b**) Dorsal and sagittal MPR views showing the stomach and small bowel dislocated in the pericardial sac
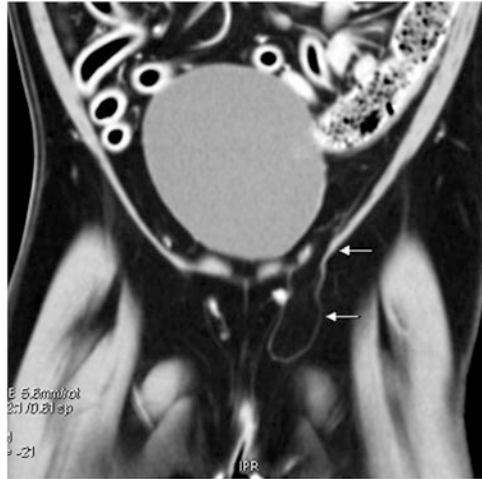
Fig. 31 Direct inguinal hernia in a young female dog. *Arrows* indicate the small sac containing omental fat
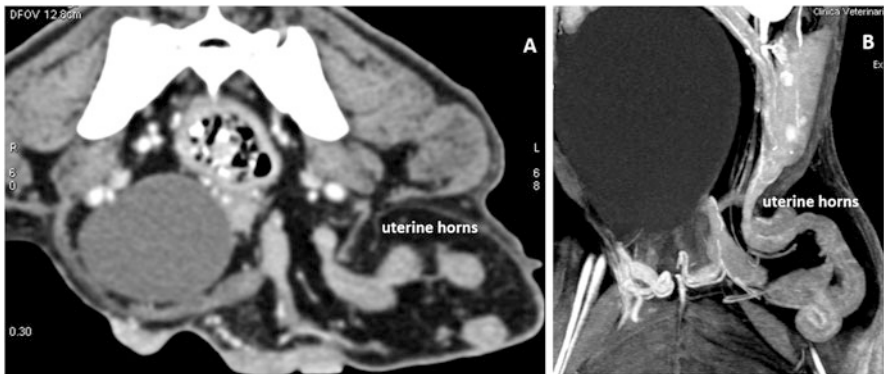
Fig. 32 Indirect inguinal herniation in a female dog with vaginal leiomyoma (not visible here). (**a**, **b**) Transverse and dorsal views showing the inguinal herniation of the uterine horns (uterine adenomyomatosis)

for other purposes. Inguinal hernias are subdivided into direct and indirect inguinal hernias. Direct inguinal hernia occurs when tissue protrudes through weakened or injured abdominal wall muscles, in a hernia sac formed by the parietal peritoneum. This kind of hernias is encountered commonly on MDCT examinations of patients with pelvic trauma and in non-traumatized dogs (Fig. 31). Indirect inguinal hernia is generally congenital and refers to the herniation of tissue into the inguinal canal through the deep inguinal ring in the tunica vaginalis. The organs most commonly
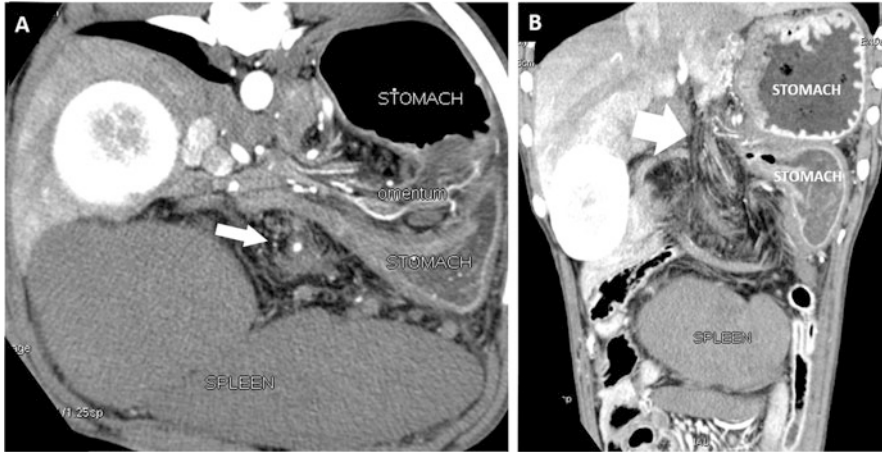
Fig. 33 Internal hernia in a dog with recurrent gastric dilatation. (**a**) Transverse view showing partial distension of the stomach with air-fluid level. The spleen is enlarged and hypoperfused. Note a "whirl sign" in the middle abdomen (*arrow*), consistent with omental torsion. (**b**) Dorsal thin-average view of the abdomen in the same dog, showing herniation through the foramen (*arrow*). Surgical findings confirmed the CT diagnosis

involved in inguinal hernia are the omentum, small intestine, bladder, and uterus (Fig. 32). They may become incarcerated or strangulated within the relatively narrow inguinal canal.

Internal abdominal hernia refers to protrusion of the viscera through the peritoneum or mesentery while remaining in the abdominal cavity. In humans, MDCT is considered to be the gold standard imaging technique for the diagnosis of these hernias. The most common presentation is acute intestinal obstruction of small bowel loops, which develops through normal or abnormal apertures, such as foramina or defects in the mesentery or visceral peritoneum. MDCT signs differ depending on the subtype of internal hernia. These hernias result in the abnormal positioning of the stomach and/or bowel loops, which show signs of obstruction or strangulation. High-quality MDCT images obtained using a multiphasic approach are necessary for the evaluation of the mesenteric vasculature, which can show engorgement, twisting, and stretching (Fig. 33). Volumetric datasets must be assessed thoroughly to exclude inflammatory and neoplastic gastrointestinal conditions. Thin-slab MIP and VR are helpful for accurate image interpretation, especially for evaluation of the course and patency of the mesenteric vasculature.

Perineal hernias differ from other hernias in that the displaced organs are not usually within a peritoneal sac. Perineal hernias form due to failure or weakening of the fascia and muscles of the perineum, which permits prolapse of abdominal or pelvic organs. This type of hernia has been described mostly in mature, male dogs. Perineal hernia is seen incidentally on MDCT or appears as a corollary sign of complex traumatic or neoplastic pelvic diseases. Perineal hernias usually involve herniated abdominal and pelvic canal contents, such as dilated rectum, prostate, urinary bladder, fat, omentum, and/or small intestine (Fig. 34).
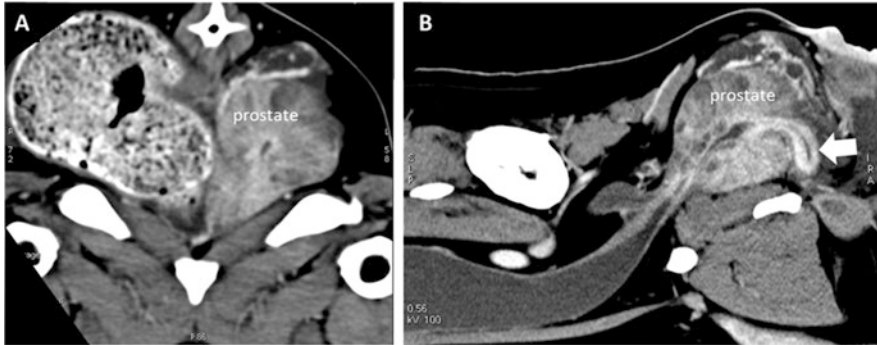
Fig. 34 Perineal hernia in a dog. (**a**) Transverse view of the pelvis showing dislocation of the prostate and rectum with feces. (**b**) Sagittal view from the same patient, showing caudal dislocation of the prostate and urethra (*arrow*)

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