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Abscess, Renal and Percutaneous Drainage of Kidney

- Renal abscess is defined as a parenchymal fluid-filled mass of infectious origin containing suppurative material and delineated by a pseudocapsule. It is usually a sequela of acute renal infection, in particular pyelonephritis or bacterial nephritis, and although the inflammatory process is reversible, it can occasionally result in liquefactive necrosis and abscess formation.
- *CT*: CT is the most accurate modality for the detection of renal abscess; it usually appears as a spherical mass with a thick wall; gas may be visible within the collection. After contrast administration, abscess wall enhances, whereas there is no central enhancement ("ring" sign or pseudocapsule) within the parenchyma surrounded by an area of hypoattenuating cortex at the nephrographic phase. Fascial and septal thickening are usually present. MRI: rim enhancement of masses >1 cm. The puncture and drainage of most abscesses can be performed with CT guidance. When the upper pole is involved, CT is indicated to avoid trauma to the spleen or pancreas.

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- A perinephric abscess may develop directly from acute pyelonephritis, but it can also result from rupture of a renal abscess into the perirenal space or from extension of inflammatory disease outside Gerota's fascia; it can even involve iliopsoas muscles and extend to the pelvis.

Abscess, Prostatic

- Prostate abscess is a closed pocket containing pus within the prostate. Predisposing factors for periprostatic or prostatic abscesses are diabetes mellitus, urethral catheterization or manipulation, and an immunocompromised status. Most abscesses are infected; any portion of the prostate can be involved and it can communicate with the urethra.
- CT: CT can detect a prostatic abscess (single or multilocular area of low attenuation). Once diagnosed, it can be drained using endorectal US guidance, and a perineal or transurethral drainage approach can be used.
- MRI: MR imaging is usually not performed for this condition, an abscess should be suspected when a cystic lesion with thickened walls, septa, or heterogeneous contents is seen in a patient with typical clinical finding T1W can show enlargement with or without a decrease in signal intensity. On T2W images, the abscess shows higher signal intensity than the adjacent peripheral zone. The postcontrast acquisition can show a typical peripheral strong enhancement.

Abscess, Tubo-ovarian

- It is the term for a variety of infections that involve the fallopian tubes, the ovaries, and the surrounding tissues and often

originates from pelvic inflammatory disease; other causes, less frequent, can be Crohn's disease, diverticulitis, perforated appendicitis, and pelvic surgery.
- Symptoms vary in large scale and may be atypical: lower abdominal pain, fever, elevated blood C-reactive protein level, and adnexal tenderness.
- CT: The abscess manifests as bilateral thick-walled, fluid-filled adnexal masses. The abscess wall and adjacent soft tissue inflammation enhance intensely. Internal gas bubbles, which are unusual, are the most specific sign of an abscess.
- MRI: Tubal enlargement can be easily seen on MRI images and is characterized by the tortuous folding of fluid-filled structures on T2-weighted images. Associated findings include thickening of the uterosacral ligaments, infiltration of the presacral fat secondary to edema, hydronephrosis, and indistinct margins of adjacent bowel loops.
- Treatment classically consists of antibiotics or surgery (such as laparoscopy or laparotomy with drainage of the abscess, unilateral or bilateral adnexectomy, or hysterectomy).

Adenomyomatosis of the Uterus

- It is a benign disease of the uterus, relatively common in women of reproductive age. It is characterized by the presence of ectopic endometrial tissue (glands and stroma) within the myometrium.
- Most patients present with menorrhagia and dysmenorrhea. Three different forms may be identified: diffuse adenomyosis (most common form), focal adenomyosis/adenomyoma, and cystic adenomyosis.
- MRI: MRI is the modality of choice for the diagnosis, with a very high sensitivity and specificity. On T2W sequences, it is indicated by an irregular thickening of the junctional zone of

the myometrium, often containing some small high T2 signal regions, which correspond to islands of endometrial glands with cystic change or hemorrhage. After administration of contrast, it may show enhancement of the ectopic glands.
- CT: CT is not routinely used as it is unable to diagnose adenomyomatosis.

Adnexal Torsion

- It is an uncommon gynecological emergency, potentially lethal, that may occur in women of any age, but it is more common during reproductive age. It is the result of axial rotation of the ovary and/or the fallopian tube about its vascular pedicle; it is generally unilateral, with a slight right-sided predilection. This condition may be partial or total, and it can be intermittent or maintained. It causes severe lower abdominal and pelvic pain due to arterial and venous stasis; if untreated, the torsed ovary becomes hemorrhagic and often necrotic.
- CT and MRI: CT and MRI may be useful when a sonogram is indeterminate. CT and MRI show an enlarged, usually edematous, or in some cases hemorrhagic ovary, with peripheral follicles; lack of enhancement may be seen. The involved ovary can assume a midline position; other common findings include a small amount of free fluid and engorgement of blood vessels. MRI is not the imaging modality of choice as urgent imaging is required; it demonstrates hyperintensity on both T1W and T2W sequences due to its edematous and hemorrhagic composition.

Agenesis, Renal

- Congenital absence of one (unilateral) or both (bilateral) kidneys. If bilateral (Potter syndrome), the condition is fatal,

whereas if unilateral, patients can have a normal life expectancy and it could be asymptomatic.
- CT and MRI: CT and MRI show the absence of a kidney, with associated hypertrophy of the remaining kidney to compensate. An empty renal fossa does not always mean renal agenesis: it is really important to ensure that the kidney is actually missing (i.e., check for a pelvic ectopic kidney or cross-fused renal ectopia).

Amyloidosis of the Kidneys

- Amyloidosis is a constellation of diseases resulting in the deposition of abnormal protein (amyloid) in various tissues. It can be primary, if associated with monoclonal plasma cell dyscrasias, or secondary, if associated with chronic inflammatory processes (tuberculosis, rheumatoid, arthritis, Crohn's disease, etc.). Lymphoproliferative disorder should be excluded.
- CT and MRI: Imaging findings are not specific. CT and MRI may show enlarged kidneys in acute stages, while in chronic stages, kidneys may appear smaller than normal.

Amyloidosis of the Bladder

- Primary bladder amyloidosis is rare; more often, it is secondary bladder amyloidosis, both presenting with hematuria. The diagnosis is made by histologic examination. Once detected, systemic amyloidosis or a malignant lymphoproliferative disorder should be excluded.
- CT and MRI: It results in a thickened, irregular bladder wall, and the imaging appearance mimics that of an infiltrating neoplasm. Magnetic resonance imaging reveals amyloid infiltration as a hypointense region on T2-weighted images.

Androgenital Syndrome (AGS)

- Also called congenital adrenal hyperplasia, it is an autosomal recessive condition leading to impaired hormone synthesis: cortisol and aldosterone, produced in the adrenal glands. In 95 % of cases, the genetic alteration is to deficiency of the enzyme 21-hydroxylase.
- Clinically, girls and women develop virilization and boys have precocious puberty. In a subject that has a clinical suspicion, the diagnosis of 21-hydroxylase deficiency is done by evaluating the value of baseline plasma 17-OH progesterone (very high in the classical forms) or after ACTH stimulation.
- CT and MRI reveal large adrenals that are cerebriform in outline. Adrenal rest tissue in other locations also enlarges. This condition should be suspected in an infant with enlarged adrenal glands. Acquired adrenogenital syndrome is most often due to an adenoma and less often to an adrenocortical carcinoma.

Angiography, Renal

- It is an x-ray study of blood vessels to the kidney; contrast is injected into a catheter that has been placed into renal blood vessels. It provides diagnostic imaging, and also endovascular therapy can be applied in the same sitting.
- It is performed to evaluate various vascular conditions, such as aneurism and stenosis.

Angiomyolipoma, Renal (AML)

- The most common benign tumor of the kidney. It is composed of abnormal blood vessels, smooth muscle, and fatty

components. Angiomyolipomas are strongly associated with a genetic disease called tuberous sclerosis, in which most individuals have several angiomyolipomas affecting both kidneys. They are also commonly found in women with a rare lung disease, lymphangioleiomyomatosis. It is often found incidentally when the kidneys are imaged for other reasons or as part of screening in patients with tuberous sclerosis. Ninety percent are unilateral and single; 10 % are multiple and bilateral. Symptomatic presentation is most frequently with spontaneous retroperitoneal hemorrhage; the risk of bleeding is proportional to the size of the lesion (high risk if >4 cm in diameter).

- The best diagnostic clue consists of an intrarenal fat-containing mass, but a proportion of angiomyolipomas are fat-poor (numbers). CT: well-marginated cortical heterogeneous tumor, with a variable amount of fat. Variable enhancement pattern based on the amount of fat and vascular components. Rare calcifications. MRI: variable signal intensity. It shows hyperintensity on T1 sequences, signal loss in fat-suppression sequences, and significant enhancement after contrast administration if the tumor contains high vascular components.

Anterior Pararenal Space

- It is the portion of retroperitoneum that extends between the posterior surface of the parietal peritoneum and the anterior reflection of perirenal fascia. It is bounded laterally by the lateroconal fascia.
- This area contains the pancreas, duodenal loop, retroperitoneal segments of the ascending and descending colon, the roots of the small bowel mesentery, and transverse mesocolon.

- It is difficult to identify on CT/MRI in normal conditions, but it becomes more visible if there is a fluid collection or a disease process; moreover, fluid can separate the two layers of the perirenal fascia and collect behind the kidney. Disease or fluid in the anterior pararenal space usually originates from pancreatitis, perforating/penetrating ulcer, and diverticulitis.

ARPKD and ADPKD

- Autosomal recessive or dominant polycystic kidney disease: An inherited progressive condition that may manifest in different ages and with varying expression, potentially deleterious to renal function.

Arteriovenous Communications

- It is a very uncommon condition; 70–80 % of arteriovenous communications in the kidney are arteriovenous fistulas (AVFs). The most common causes of AVF are penetrating traumas, but it can also be idiopathic or it can be secondary to surgery, tumors, and inflammation, post biopsy.
- The best diagnostic choice is contrast-enhanced CT; these lesions enhance to the same extent as the adjacent aorta, while thrombosed lesions show no contrast enhancement. Visualization of an enlarged feeding renal artery and draining vein confirms the nature of AVF.
- Treatment of choice is embolization of this fistula.

Artifacts

- Artifacts are components of the image that do not reproduce faithfully actual anatomical structures because of addition, deletion, or distortion of information. It is rather common in clinical MR imaging. They can potentially degrade images sufficiently to cause inaccurate diagnosis.
- CT: The most common CT artifacts are as follows: (1) Volume averaging: it is present in every CT image; it occurs when a dense object lying off-center protrudes part of the way into the x-ray beam. (2) Beam hardening: it results from greater attenuation of low-energy x-ray photons than high-energy x-ray photons as they pass through tissue. It produces dark streaks which extend from structures of high x-ray attenuation, such as bone, arms, high-density objects (vascular clips, dental fillings), or contrast. (3) Motion artifact: it is secondary to voluntary or involuntary movements of the patient, such as peristalsis or breathing; it produces dark streaks or organ duplication of the margin. (4) Ring artifact: if one of the detectors is out of calibration, the detector will give an erroneous reading at each angular position, resulting in a circular artifact. In particular, when central detectors are affected, they will create a dark smudge at the center of the image.
- The most common MRI artifacts are as follows: (1) Motion artifact: it can cause ghost image of the moving structures or it can produce blurring of the image. Spin-echo sequences, particularly those with long echo times, are especially sensitive to motion. The most common causes of image degradation due to motion are breathing, peristalsis, and flow-related artifacts. (2) Chemical shift misregistration: when substances of markedly different molecular composition are immediately adjacent to each other, localized image misregistration

occurs at the interface between the two substances, due to different resonant frequencies. It produces a line of high signal intensity on one side of the fat–water interface and a line of signal void at the opposite side of the interface; it can be frequently seen along the bladder wall or renal margins. (3) Magnetic susceptibility artifact: it refers to a distortion in an MR image induced by a metallic object, such as orthopedic devices, surgical clips, and wires. It produces an area of signal void and a distortion of the image close to the metal implant. (4) Aliasing ("wraparound artifact"): it occurs when a body part is larger than the imaging field; those portions outside the field will be projected back upon the primary image.

Ascites

- Ascites means fluid in the peritoneal cavity. Classic ascites is either a transudate or exudate based on total protein concentration. The most common cause of ascites is portal hypertension due to liver disease; other causes are peritoneal carcinomatosis, infections, and conditions leading to hypoalbuminemia. It can also appear in patients with end-stage renal disease, called nephrogenic ascites, probably due to altered peritoneal membrane permeability or impaired resorption secondary to peritoneal lymphatic obstruction.
- CT: Ascitic fluid may enhance on delayed contrast-enhanced CT. MRI: A transudate is hypointense on T1-weighted images and hyperintense on T2-weighted images, whereas an exudate has a higher signal intensity on T1-weighted images than a transudate (explain why! Contents of the fluid).

Suggested Reading

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