

# C

## **Claustrophobia**

- 20 % of general population have claustrophobia.
- Patient positioning important: Try prone position or head outside the bore or gantry.
- Mild sedation (e.g., benzodiazepine) can be applied.

## **Cervical Carcinoma**

- Cervical epithelium can undergo a series of gradual histologic changes from progressively severe dysplasia to carcinoma in situ (CIS) and invasive carcinoma.
- Invasive carcinoma spreads by direct extension to adjacent organs: vagina, pelvic wall, bladder, and rectum. Metastatic lymphadenopathy occurs commonly in the pelvic lymph nodes, but it also involves the periaortic chains in about 20 % of patients.

- The identification of cervical carcinoma in MRI is simple because the high-signal-intensity lesion contrasts with the marked low-signal-intensity cervical stroma on T2W images. Areas of coagulative necrosis may appear as small foci of lower signal intensity within the tumor mass.
- Tumors responding to treatment generally lose signal intensity on T2W images.
- T1W images often doesn't detect smaller lesions because of a lack of contrast between the cervix and tumor.

## **Cryptorchidism**

- The prevalence of undescended testis is 3.5 % at birth and decreases to 0.8 % by 1 year, because many testes descended spontaneously.
- Identification of undescended testis is important because of the increased incidence of infertility and neoplasm if the testis remains undescended.
- If US findings are equivocal or negative and/or a preoperative localization is desired, either CT or MRI can be performed.
- MRI is the best cross-sectional modality to assess cryptorchidism. A disadvantage of MRI in children, compared with CT, is the lack of a contrast agent to opacify bowel loops, which makes detection of the atrophic testis more difficult. Young children require sedation which may be a limiting factor for MR imaging.
- The CT features of an undescended testis are an oval and soft tissue mass located anywhere along the pathway of testicular descent. The accuracy of CT for localization of non-palpable testes exceeds 90 %. Unless it is atrophic or ischemic, the undescended testis has an intermediate signal intensity equal to that of muscle on T1-weighted images and higher than that of subcutaneous fat on T2-weighted images. Coronal T1W images can show gubernaculum testes and spermatic cord,

which can be followed to locate the undescended testes. Diffusion-weighted MRI shows markedly hyperintense testes and helps to differentiate it from surrounding structures.

## Cystectomy

- Cystectomy is the surgical removal of the urinary bladder; it is most commonly performed for bladder cancer treatment. After the bladder has been removed, an ileal conduit urinary diversion is necessary. An alternative is to construct a pouch from a section of the ileum or colon, which can act as a form of replacement bladder.
- Because of the complexity of these procedures, early and late postsurgical complications are frequent (including hematoma, urinoma, and abscess); CT is an accurate method for detecting these complications.
- Afterwards, a cutaneous ureterostomy CT allows the accurate depiction of ureters and their surgical anastomoses to the anterior abdominal wall.
- After, an ileal conduit creation multidetector CT allows visualization of the ureters up to the point of anastomosis to the ileal conduit. It is important to evaluate also the enteroenteric anastomosis, most often visible because mechanical suturing is usually performed.
- Subsequently, in continent cutaneous diversion at multidetector CT, the reservoir appears to be partially filled by hypodense material, a characteristic that represents mucous secretions from the bowel.
- Subsequently, an orthotopic bladder replacement multidetector CT allows the identification of a bowel loop in anatomic continuity with the reservoir, a finding that corresponds to the isoperistaltic afferent limb.
- Early complications:

- Adynamic ileus is the most common bowel complication after urinary diversion surgery: it is characterized by dilated loops of small and large bowel with gas–fluid levels and by the absence of a visible cause of obstruction. A CT-based diagnosis of adhesive small bowel obstruction may be made in the presence of an abrupt change in bowel caliber and the absence of another cause of obstruction.
- Fluid collection: The differential diagnosis of postsurgical fluid collections includes urinoma (*see* section “[Urinoma](#)”), hematoma, and lymphocele. Unenhanced and nephrographic phase in the presence of hematoma shows a non-enhancing heterogeneous fluid collection. The CT finding of a homogeneous fluid collection with a very thin wall near the surgical clips is suggestive of lymphocele.

## Contrast-Induced Nephropathy

- Contrast-induced nephropathy (CIN) is defined as the impairment of renal function; it is measured as either a 25 % increase in serum creatinine (SCr) from baseline or 0.5 mg/dL (44 μmol/L) increase in absolute value, within 48–72 h of intravenous contrast administration. Following contrast exposure, SCr levels peak between 2 and 5 days and usually return to normal in 14 days.
- CIN is one of the leading causes of hospital-acquired acute renal failure. It is associated with a significantly higher risk of inhospital and 1-year mortality, even in patients who do not need dialysis.

## Calyceal Diverticulum

- A calyceal diverticulum represents a congenital malformation of the collecting system. These diverticula are usually

centrally located within the kidney, adjacent to the pyramids and collecting system. Although most calyceal diverticulum are small ( $1 < \text{cm}$ ), occasionally they can be quite large. The incidence of calyceal diverticula is low; the frequency of stone formation within them is high.

- Many calyceal diverticula communicate freely with the collecting system and become opacified during either antegrade or retrograde urography as well as during CT (late phase). Occasionally, the neck of the diverticulum is stenotic, and the diverticulum becomes only faintly opacified or, in some cases, not at all. Detection of faint opacification of a calyceal diverticulum at CT can be assisted by comparing the attenuation within the “cyst” on delayed imaging sequences with the patient first supine and then prone.

## Cystitis

- It is the inflammation of the bladder, usually caused by a bladder infection.

Bladder infections can be caused by inappropriate bladder emptying, damage or irritation around the urethra, and bacteria being transferred from the anus to the urethra.

- Symptoms of cystitis include pain; burning or stinging sensation when urinating; needing to urinate often and urgently but passing only small amounts of urine; urine that's dark, cloudy, or strong smelling; hematuria; and pain low in the belly or in the lower back or abdomen.
- For patients who have frequent episodes of cystitis or in the presence of antibiotic resistance, the possibility of an underlying abnormality should be considered; in such cases, the entire urinary tract should undergo imaging.
- CT scanning is useful when calculus disease, bladder diverticula, colovesical fistula, or perivesical abscess is under consideration.

- In cases of cystitis, MRI findings are nonspecific; the appearance is that of focal or diffuse thickening of the bladder wall. On T2-weighted images, 4 layers of the bladder wall are appreciated. After the intravenous administration of gadolinium-based contrast agent, variable enhancement of the bladder wall is observed. The intensity of enhancement depends on the severity of the inflammatory process.
- MRI is particularly suited for the diagnosis of hemorrhagic cystitis. MRI may demonstrate changes of hemorrhagic cystitis and may permit a determination of disease activity.

## Collecting Duct Carcinoma

- Originating from the collecting ducts of the kidney accounts for only 1 % of renal carcinomas. The age of presentation ranges from 16 to 62 years. Collecting duct tumors demonstrate aggressive behavior; a maximum survival of approximately 2 years is reported.
- CT demonstrates renal medullary involvement with an infiltrative appearance and renal sinus encroachment. The reniform contour of the kidney is preserved except when an expansive component is present.
- Collecting duct carcinomas are hypointense on T2-weighted images and hypovascular on angiography. However, there are no specific radiological findings of this entity.
- *Wilms' tumor*: Wilms' tumor represents 87 % of pediatric renal neoplasm. The most common clinical presentation is an enlarging abdominal mass; less common symptoms include abdominal pain, fever, and hematuria. This tumor requires resection and preoperative imaging CT and/or MRI.
- On CT, a Wilms' tumor usually appears as a spherical intrarenal mass, often with a pseudocapsule surrounding it. The tumor is less dense than the normal renal parenchyma on

contrast-enhanced CT scans; areas of attenuation coincide with tumor necrosis, fat deposition, or both. Perinephric tumor extension thickens the renal fascia and obliterates the perinephric fat. Central retroperitoneal adenopathy can be detected by CT. Renal vein and inferior vena caval tumor extension may be shown after an intravenous bolus injection of contrast medium.

- On MRI, Wilms' tumor appears as a large, well-defined mass with relatively distinct margins. It has low signal intensity on T2W images. The tumor often appears heterogeneous on both T1W and T2W images. Currently, CT and MRI appear equivalent for staging Wilms' tumor. However, MRI shows venous extension better than CT.
- *Nephroblastomatosis*: Foci of persistent metanephric tissue are designated as nephrogenic "rests." The presence of multiple nephrogenic rests is termed nephroblastomatosis, which is a precursor lesion to Wilms' tumor. Nephroblastomatosis occurs most often in neonates and is characterized by multiple bilateral subcapsular masses.
- CT is the gold standard. On contrast-enhanced CT, the rests enhanced less than the adjacent normal parenchyma. The hallmark of neoplastic transformation of a benign nephrogenic rest is enlargement on serial CT scans.
- On MRI, nephroblastomatosis tends to be hypointense to renal cortex on T1W images and isointense to cortex on T2W images.
- *Renal sarcoma*: Primary renal sarcomas are rare mesenchymal tumors that often have a poor prognosis. Subtypes of this neoplasm include leiomyosarcoma (the most common renal sarcoma, accounting for about 58 % of all), angiosarcoma, hemangiopericytoma, liposarcoma, rhabdomyosarcoma, fibrosarcoma, and osteosarcoma.
  - Capsular localization, a feature of more than 50 % of these tumors, should suggest the diagnosis on CT. When these neoplasms arise in the renal parenchyma, they are

indistinguishable from RCC in CT images. On CT, liposarcoma causes compression without invasion of the renal parenchyma and shows a variety of appearances correlating with their gross and histological features. For example, tumors containing a large amount of mature fat show negative attenuation values and myxoid liposarcoma contains little mature fat, and their predominantly fluid and connective tissue composition results in attenuation values nearer those of water.

## **CT-Guided Biopsy of the Kidney**

- CT is the second-choice modality if the problem is not well seen by ultrasound. The main indication is the presence of a mass of indeterminate nature not identifiable with other methodologies. In most patients, the approach is posterior, with the trajectory chosen to avoid the erector spinal muscle (after anesthetizing locally the renal capsule).
- Cystic masses: Aspirate the fluid and define the thickening of the wall by injecting urographic contrast material. Try to sample, eventually, the solid portion of the mass or the wall thickening. Solid masses: A bolus dynamic scan must be performed to assess vascularity; in case of slightly increased vascularity, aspiration is quite safe.
- The accuracy rate for diagnostic aspiration of renal mass is approximately 100 %. Complications related to such procedures are quite low.

## **Contrast-to-Noise Ratio**

- Relative signal-to-noise differences from two different regions.
- $CNR = (S_1 - S_2) / \sigma$ .



- $S_1$  and  $S_2$  = mean signal intensity from the two regions;  
 $\sigma$  = standard deviation of the background noise.

## Conversion Factors, Radiation Dose

- Estimate of effective dose from the DLP.
- Conversion factor used: European Commission. European guidelines on quality criteria for computed tomography, EUR 16262EN. Luxembourg: Office for Official Publications of the European Communities, 2000. Available at [www.dr.s.dlk/guidelines/ct/quality](http://www.dr.s.dlk/guidelines/ct/quality).
- $E_{\text{eff}} = \text{Conversion Factor} \cdot \text{DLP}$ .

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