

# P

## **Pelvic Inflammatory Disease**

- Pelvic inflammatory disease (PID) is a common condition among women of reproductive age and is usually caused by infection ascending from the endocervix through the uterine cavity.
- Patients usually present with a myriad of nonspecific symptoms, including fever, abdominal or pelvic pain, vaginal discharge, uterine bleeding, dyspareunia, dysuria, adnexal or cervical tenderness, nausea, vomiting, and other vague constitutional symptoms. Laparoscopy, which allows direct visualization of purulent exudates and edema of the pelvic structures, has long been the standard of reference in the diagnosis of PID, but it requires general anesthesia and is an expensive and invasive procedure.
- CT: CT findings are typically subtle early in the course of PID. Mild pelvic edema that results in thickening of the uterosacral ligaments and haziness of the pelvic fat with obscuration of the pelvic fascial planes are seen in the initial phase. Later in the course of PID, the fallopian tubes exhibit an even greater degree of wall thickening and enhancement and fill

with complex fluid, findings that usually indicate pyosalpinx. 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 MR 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.

## **Penis Prosthesis**

- Penis prosthesis is a treatment option for men with erectile dysfunction. There are two main types of penile implants: semi-rigid and inflatable.
- MRI can clearly demonstrate the position of both semirigid and inflatable prostheses. The saline solution in inflatable devices is well seen with T2-weighted sequences; the silicone in semirigid devices has low signal intensity on T2-weighted images.

## **Peyronie Disease**

- Peyronie disease is a common acquired condition, with a prevalence of around 3 %, associated with penile curvature and a palpable plaque in the tunica albuginea and adjacent corpus cavernosum. The plaque is mostly located unifocally in the penile dorsum with an extension of about 1.5–3 cm causing a typical dorsal deviation. Morphologically, an inflammatory

reaction with thickening of the tunica in the beginning, later on a fibrotic, often calcified plaque is typical.

- Plaques from Peyronie disease are usually palpable and are visible at both US and MR imaging in the majority of cases.
- CT is not routinely used and can only show calcification.
- MRI: Plaque formation has been associated with low signal intensity, disruption, localized thickening, and irregularity of the adjacent tunica albuginea with both T1- and T2-weighted sequences. Erection induced by the injection of Prostaglandin E1 stretches the tunica albuginea improving the conditions for plaque detection. The intravenous application of paramagnetic contrast medium leads to an increased local signal intensity (T1-weighted) depending on the degree of tissue perfusion with a focal contrast enhancement around or within the plaques indicating an inflammatory status of the plaque.

## Polycystic Kidney Disease

- The Potter classification of renal cystic diseases separates cystic kidneys into four types: (1) infantile polycystic kidney disease; (2) cystic dysplastic kidney disease; (3) adult polycystic kidney disease; and (4) partial or intermittent urinary outflow obstruction (obstructive dysplasia).
- *Autosomal Recessive Polycystic Kidney Disease (ARPKD)*: also known as Potter type I and infantile polycystic disease, the autosomal-recessive form of polycystic kidney disease manifests early in life. The underlying defect is renal tubular ectasia. The nephrons are normal. Expressivity varies with some patients not surviving beyond the neonatal period. Those with milder renal involvement survive longer and develop hepatobiliary fibrosis and dilated bile ducts. In the infantile form, numerous small cysts (several millimeter range) develop throughout, the kidneys are markedly

enlarged, poor function is evident early on, and renal failure gradually ensues.

CT: CT reveals renal cysts to be near water density unless superimposed bleeding occurs.

MRI: Renal cysts appear rounded well-defined structures with very thin regular walls; these cysts vary from hypo- to hyperintense both with T1- and T2-weighted images, presumably due to prior hemorrhage.

- *Autosomal Dominant Polycystic Kidney Disease (ADPKD)*: also called adult polycystic kidney disease and Potter type III, is the most common hereditary renal disorder. Renal failure is a late finding. These patients are also prone to developing aortic and cerebral aneurysms with their related complications.

Clinical presentation is variable and includes dull flank pain of variable severity and time course: most common, abdominal/flank masses, hematuria, and hypertension.

CT: CT shows most cysts to resemble simple cysts, although hemorrhage into cysts is common and these are hyperdense to water. The walls are very thin and regular and are often imperceptible. Some have a fluid–fluid level or even appear as a solid tumor. Renal calcifications are generally secondary to calculi, prior hemorrhage into a cyst, or cyst wall calcifications.

MRI: Renal cysts appear rounded well-defined structures with very thin regular walls; these cysts vary from hypo- to hyperintense both with T1- and T2-weighted images, presumably due to prior hemorrhage.

## **Polycystic Ovarian Disease**

- Polycystic ovarian disease (Stein–Leventhal syndrome) consists of oligomenorrhea, anovulation, hyperandrogenism, and

obesity in a setting of enlarged, polycystic ovaries. Serum-luteinizing hormone levels are increased and follicle-stimulating hormone levels are decreased. Infertility is common.

- It is usually diagnosed clinically. Both ovaries are affected and may be enlarged or normal in size.
- CT: CT detects enlarged ovaries containing numerous small cysts, generally uniform in size. In some women the cysts are sufficiently small, making their identification difficult. The cysts are close to water density. Hemorrhage is rare.
- MRI: MRI reveals subcortical cysts and a thickened fibrotic capsule; with a hypointense signal from these cysts on T1- and hyperintense signal on T2-weighted images. In contrast to normal ovaries, follicles seen in polycystic ovarian disease are typically smaller than 1 cm and are uniform in size and appearance.

## **Polyps, Endometrial**

See section “[Endometrial polyp](#)”.

## **Prostatic Adenoma**

See Chapter 2 “[Benign Prostatic Hyperplasia](#)”.

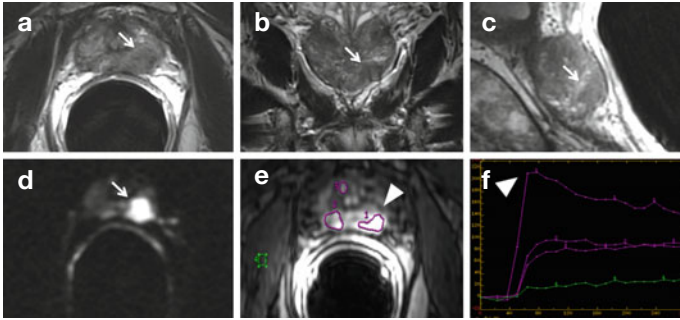
## **Prostatic Cancer**

- Prostatic cancer is one of the most frequent and most commonly diagnosed cancer in men.

- Adenocarcinoma accounts for about 95 % of all prostatic malignancies. Mucinous adenocarcinomas of the prostate are uncommon, and their prognosis is worse than that of a more typical adenocarcinoma.

The most common initiator for a search for prostate carcinoma is a screening of an elevated PSA level. Examinations used in prostate cancer detection include digital rectal examination, transrectal US, MRI, and US-guided transrectal biopsy.

- CT: Nonhelical CT detects an enlarged gland but cannot distinguish between BPH and a neoplasm. Carcinoma is suggested only by an irregular contour outline. Helical CT, on the other hand, identified cancer in 88 % of patients as peripheral zone regions of contrast enhancement; transitional zone cancers, on the other hand, appear similar to benign nodules.
- MRI: On T2-weighted images a prostatic carcinoma typically is hypointense relative to the higher signal intensity of the normal peripheral zone. A hypointense peripheral zone is not pathognomonic for a prostatic cancer; prostatitis, benign prostatic hyperplasia, or biopsy hematoma can have a similar appearance. A wedge shape and diffuse extension without mass in a hypointense peripheral zone suggest benignity, while a large size is associated with malignancy. Cancers in the central and transitional zones are difficult to identify with MRI; when large, they tend to disrupt the normal gland architecture. Dynamic contrast-enhanced images may provide better tumor definition by outlining tumor margins more clearly than with unenhanced images. Diffusion-weighted imaging may predict the aggressivity of the cancer and is useful for detection; Fig. 7.
- <sup>1</sup>H-MR spectroscopy reveals a correlation between water T2-relaxation time and tissue citrate concentration. Significantly higher choline levels and significantly lower citrate levels are found in cancer tissue compared with BPH and normal tissue. Men with cancer have a significantly lower citrate-to-choline ratio than those with BPH.



**Fig. 7** An huge hypointense mass is spotted (*white arrow*) on the left part of the peripheral zone (**a**) on axial T2-weighted imaging. Sagittal and coronal scans (**b**, **c**) help to precisely locate the tumor (*white arrow*) which is in the prostate apical section. Diffusion imaging (**d**) highlights an hyperintense focus (*white arrow*) while on perfusion imaging (**e**) the single ring of interest labeled with number 1 (*arrowhead*) shows on intensity/time curve (**f**) a malignant pattern, consisting in a rapid wash-in and a delayed wash-out of contrast medium (*arrowhead*)

## Prostatitis

- Prostatitis can be either acute or chronic. At times, a specific pathogen is detected; if not, the clinical symptoms are often ascribed to prostatodynia.
- Ultrasonography reveals a complex pattern in prostatitis.
- Early prostatic cancer and prostatitis are difficult to differentiate with current imaging.
- MRI: MRI in some patients with prostatitis MR spectroscopy detects an elevated choline peak and reduced or no citrate, mimicking cancer. Areas with prostatitis tend to enhance fast and show washout on dynamic contrast-enhanced MR imaging.

## **Pyelonephritis Acute**

- Acute pyelonephritis (APN) primarily results from bacterial infection of the kidney by an ascending route that causes a tubulointerstitial inflammation of the renal parenchyma.
- The diagnosis is traditionally based on a combination of laboratory findings and typical clinical features, including flank pain, high-grade fever, and urinary tract infection (UTI).
- Imaging is not routinely indicated in patients with APN, and treatment, which consists of intravenous antibiotics, can be started on the basis of typical clinical and laboratory features. Situations in which imaging is indicated include exclude obstructed kidney, high-risk patients (diabetics, elderly, and immunocompromised), those with mixed clinical picture, previous renal pathology.
- TC: Typical features of acute pyelonephritis include an ill-defined, wedge-shaped area of decreased attenuation radiating from the papilla in the medulla to the cortical surface. Other findings on CT in acute pyelonephritis include focal or global enlargement of the kidney, thickening of Gerota's fascia, stranding of perinephric fat, and obliteration of perinephric fat planes. Pelvicalyceal wall thickening and enhancement secondary to ascending infection may be the only imaging feature of a kidney affected by acute pyelonephritis.
- MRI: An affected area will have low signal intensity on T1-weighted images and increased signal intensity on T2-weighted images, with a loss of normal corticomedullary differentiation. Perinephric fluid is also commonly seen but is not a specific finding for acute pyelonephritis. The use of gadolinium is essential in correctly depicting areas of renal involvement. MRI features of pyelonephritis mimic those of CT, with renal enlargement, perinephric stranding, focal areas of decreased enhancement, and striated pyelogram. Associated abscess cavities are also well seen.



## Pyocele

- A pyocele consists of pus in the tunica vaginalis, generally secondary to an epididymo-orchitis or rupture of a testicular abscess.
- MRI: Abscesses are typically hypointense on T1-weighted images and hyperintense on T2-weighted images, compatible with fluid content, and T2-weighted images demonstrate a hypointense rim; on contrast-enhanced T1-weighted images, the lesion does not enhance, but the surrounding parenchyma shows avid enhancement.

## Suggested Reading

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