Ultrasound of the reproductive system: male dog
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Preparation and scanning procedure
Ultrasoundographic examination of male reproductive organs is commonly performed for andrologic evaluation of breeding dogs, localization of retained testicles, difficulties or abnormalities in urination or defecation, abdominal, scrotal, and penile pain or discomfort, caudal abdominal mass lesions, perineal hernia, clinical signs compatible with hormonal imbalances (hyperestrogenism), scrotal or penile trauma, and palpable scrotal abnormalities.

The dog is usually positioned in dorsal recumbency. A 5.0-MHz curvilinear transducer is appropriate in larger dogs but a 7.5- or 10-MHz transducer provides better detail and is recommended for most examinations. The prostate can be readily seen from a transabdominal approach and is located by following the bladder caudally to its terminus. Examination is performed in transverse and sagittal planes. In neutered dogs with an empty or intrapelvic bladder, ultrasonographic assessment of the prostate may identify only a small hypoechoic widening of the urethra.

The testicles should be examined with a high-frequency transducer (at least 7.5 MHz). A linear transducer with broad contact area and good resolution in the near field is preferable. Clipping of the scrotum is usually unnecessary.

The penis is occasionally examined to identify urethral abnormalities or to assess integrity of the os penis. Dependent on the examiner’s preference, a linear or curvilinear high-frequency transducer (7.5 MHz or higher) may be used. The examination is started at the level of the os penis and is continued proximally to the level of the ischium. It is important to recognize that the intrapelvic portion of the urethra cannot be visualized with ultrasound.

Normal sonographic anatomy
Prostate
The location, size, and echogenicity of the prostate varies with age, previous disease, and neutering status. In intact dogs, the prostate is of medium echogenicity and homogeneous, with a fine to medium coarse echotexture and smooth margins. In the sagittal imaging plane, the prostate is rounded to ovoid. In transverse, the two prostatic lobes can be seen distinctly and should appear symmetrical. The vertical raphe and prostatic urethra with surrounding urethralis muscle are generally visible as a hypoechoic area between both lobes. The urethral structures may be associated with edge shadowing on transverse images, which should not be misinterpreted as a lesion. Normal aging changes the appearance of the prostate resulting in increased size and mottled echogenicity. Prostatic cysts are a common incidental finding in older dogs. Prostatic size in intact dogs is significantly correlated with age and body weight. In neutered dogs, the prostate is small, inconspicuous, hypoechoic, and homogeneous. The two lobes cannot be distinguished.

Testicles
Normal testicles are of medium echogenicity and have a fine, homogeneous echotexture. In the sagittal imaging plane, a central hyperechoic line is visible that represents the mediastinum testis. In transverse, the mediastinum testis appears as a centrally located hyperechoic dot.

The head and tail of the epididymis are located at the cranial and caudal poles of the testicle, respectively, and the body is found dorsal to the testicle. In comparison with testicular parenchyma, the epididymis is hypoechoic and has coarse echotexture. The spermatic cord can be followed from the head of the epididymis to the inguinal ring and is characterized by the large tortuous anechoic venous structures of the pampiniform plexus.
Penis

At the level of the distal penis, the smooth, hyperechoic interface of the os penis is surrounded by penile soft tissues (glans penis) and the prepuce. The urethra is located within a V-shaped ventral groove in the os penis and is usually not visible unless distended. Proximal to the osseous part, penile soft tissues (corpus cavernosum, corpus spongiosum, and muscles of the penis) are of medium echogenicity and inconspicuous.

**Sonographic findings with common reproductive disorders**

Benign prostatic hyperplasia (BPH) is a common condition in older dogs and is often an incidental finding. The prostate is enlarged, of normal to increased echogenicity, and of homogeneous or inhomogeneous echotexture with multiple variably sized cysts frequently being present. Enlargement is typically symmetrical and surrounding structures are unaffected.

Benign prostatic hyperplasia is often present in conjunction with acute or chronic prostatic infection. The prostate may be of normal size or enlarged. Echogenicity and echotexture of the prostatic parenchyma are variable, ranging from normal to heterogeneous. Although changes in echogenicity and echotexture tend to be more striking than those seen with BPH, ultrasonographic differentiation of these conditions is often not possible, and prostatitis in many cases complicates preexisting BPH. Assessment of the surrounding structures is essential as prostatitis frequently causes regional peritonitis, which manifests as hyperechoic, hazy peri-prostatic fat and pocketing of fluid. Prostatic abscesses arise in some dogs with prostatitis and appear as fluid filled cavities within the parenchyma of the gland. Abscesses usually have a thick wall around the abscess cavity, contain echogenic fluid, occasionally contain gas shadows in the case of infection with gas-producing bacteria, and may develop septation. Fungal prostatitis is rare but when present causes variable ultrasonographic changes and may mimic prostatic neoplasia.

Paraprostatic cysts are fluid-filled remnants of the Mullerian duct system that occur predominantly in older large-breed dogs. Unlike intraprostatic cysts, paraprostatic cysts are located in the vicinity of the prostate, but reside predominantly in the abdominal cavity. They may communicate with intraprostatic cavitations and can usually be traced to their origin at the prostate. The cyst wall is of variable thickness. Paraprostatic cysts contain anechoic to echogenic fluid, can become very large, may contain internal septa, and may be peripherally mineralized. Paraprostatic cysts must be differentiated from the urinary bladder.

Ultrasonographic findings with prostatic neoplasia are variable and include asymmetric prostatomegaly, mottled and heterogenous parenchyma, large cystic cavities and regions of mineralization. Extension of tumors in to the surrounding tissue or urethra may occur. Both intact and neutered dogs may be affected. Assessment of regional structures such as sublumbar lymph nodes and caudal lumbar vertebral bodies is suggested as local metastases are common with prostatic tumors.

Ultrasound is very useful for locating cryptorchid testicles which can be found anywhere between the caudal pole of the kidneys and the inguinal area. If the mediastinum testis is not developed, identification of an undescended testicle may be difficult. However, in most cases, the cryptorchid testicle appears as a smaller version of a scrotal testicle and can be readily identified. It is important to remember that abdominally and inguinally located testicles are predisposed to neoplastic transformation and can reach considerable size in this instance.

Benign testicular tumors are common and frequently incidental findings (Leydig and interstitial cell tumors). Seminomas and Sertoli cell tumors are more aggressive and can affect cryptorchid and descended testicles. These tumors have the potential for hormone production and metastases. Ultrasonographic features of testicular tumors range from circumscribed small nodules to large complex masses with disruption of normal testicular anatomy. Different tumor types cannot be distinguished
ultrasonographically. Concurrent prostatic changes such as BPH or squamous metaplasia are common, especially in hormone-producing tumors. In case of metastatic neoplasia, enlarged medial iliac lymph nodes may be seen.

Orchitis and epididymitis may occur subsequent to hematogenous spread of infectious organisms, may result from urinary tract or prostatic inflammation, or may be caused by scrotal trauma. Inflammatory scrotal disorders exhibit variable ultrasonographic characteristics, ranging from diffuse echogenicity changes of the testicle and/or epididymis to complex masses and anechoic areas subsequent to abscess formation. Fluid may accumulate within the scrotum or the scrotum may thicken. Testicular and epididymal size often increase during acute inflammation and decrease in chronic cases.

Testicular torsion most commonly affects retained neoplastic testicles. In this instance, the ultrasonographic examination shows an abdominal mass of variable size and echogenicity, with decreased or absent blood flow on color Doppler examination. Intra-abdominal and intrascrotal torsion of non-neoplastic testicles and vascular compromise of other etiology (infarction or space-occupying lesions within the inguinal ring) are rare. Depending on the degree and duration of vascular occlusion, the affected testicle may appear hyperechoic or hypoechoic, increased, normal or decreased in size, with initially normal architecture. Concurrent abdominal or scrotal effusion is common, especially in acute cases.

Scrotal trauma may result in hematoma, hematocoele, contusion, intratesticular hematoma, and testicular rupture. Scrotal hematomas with accumulation of blood within scrotal soft tissues manifest as space-occupying lesions of variable echogenicity that displace the testicle and epididymis. With hematocoele formation, there is intrascrotal fluid accumulation of variable echogenicity. Testicular contusions and hematomas appear as diffuse echogenic changes to the testicular parenchyma or mass lesions of variable echogenicity. Differentiation from testicular lesions of inflammatory or neoplastic etiology is mainly based on medical history rather than ultrasonographic characteristics. Inhomogeneous echotexture of the testicular parenchyma with loss of contour definition indicates testicular rupture.

Hydrocele manifests as anechoic to echogenic fluid adjacent to the testicles and within the scrotal sac. This may be an incidental finding if fluid quantity is small, but is more commonly found secondary to scrotal disorders or when abdominal fluid descends through the inguinal ring.

With inguinal or scrotal hernia, abnormal contents (e.g., bowel loops or mesenteric fat) may be found within the inguinal ring or scrotum. Concurrent findings include hydrocele, testicular congestion or infarction.

Common abnormalities of the penis that warrant ultrasonographic examination include urethral calculi, fracture or neoplasia of the os penis, or urethral lesions such as tumor or stricture. Lesions of the os penis cause discontinuity of its hyperchoic, smooth contour.

Percutaneous procedures

Percutaneous fine-needle aspiration or biopsy of the prostate is easily performed with ultrasound guidance. The same principles and precautions used in other interventional procedures apply. In cases of suspected prostatic neoplasia, sampling by means of traumatic catheterization or prostatic massage should be considered due to potential risk of implantation of tumor cells along the needle tract after percutaneous aspiration.

Percutaneous drainage of prostatic abscesses and in situ injection of antibiotics is a valid alternative method to surgical intervention, especially in immunocompromised patients. Percutaneous drainage of paraprostatic cysts can be performed to temporarily relieve patient discomfort. However, recurrent filling usually warrants surgery at a later stage.

Fine-needle aspiration or biopsy of intra-abdominal testicular tumors is commonly performed, following the same principles and precautions as in biopsies of other abdominal organs. Fine-needle
aspiration of intrascrotal testicles is infrequently performed in veterinary medicine. However, the procedure has a high accuracy in the diagnosis of testicular neoplasms, with a low risk of adverse effects.

References