Radiology of the dysuric dog

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CLINICAL CONSIDERATIONS

Dysuria (difficult urination) is often associated with **stranguria** (straining) and **pollakiuria** (increased frequency of urination). In such cases, much information can be provided by clinical examination, including abdominal palpation of the bladder and digital rectal examination of the bladder neck and urethra. Urinalysis findings are also often helpful. The most common differential diagnoses for dysuria include urinary tract infections, urolithiasis of the bladder and/or urethra, neoplasia of the bladder and/or urethra and urethral obstruction secondary to prostatic disease.

RADIOGRAPHY OR ULTRASOUND?

The increasing popularity of ultrasound means that it is commonly the first line of investigation in urinary tract disease. Ultrasound is an extremely useful technique for examination of the bladder, due to the natural contrast between the bladder wall and lumen provided by the anechoic urine. Ultrasound is limited for assessment of the urethra, however, in that only the portions proximal and distal to the pelvis are accessible to examination. It can be complementary to radiography in assessment of the urethra, but is not suitable for use as a survey technique to exclude urethral disease. Prostatic disease can also be readily assessed using ultrasound, but urethral integrity cannot be assessed using this technique.

It is important, though, to consider and exclude urethral disease as a cause of dysuria and hence it is usually necessary to carry out plain and contrast radiographs of the urethra, even if an abnormality is detected on bladder ultrasound. For example, in the case of neoplasia, there may be spread of the disease along the urethra and, in the case of urolithiasis, there are often further calculi along the urethra. If urinary tract rupture has occurred, positive contrast radiography will often show the site and extent of rupture more clearly than ultrasound.

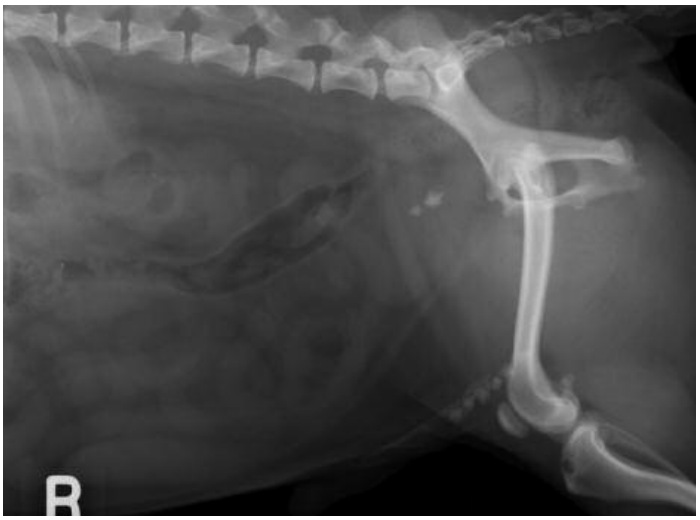

Fig. 1: *A plain lateral radiograph of a male dog; radiopaque uroliths with a spiculated margin are present in both bladder and penile urethra.*

PLAIN RADIOGRAPHY

In many cases, this will be the first diagnostic imaging examination undertaken. If a lower urinary contrast study is planned, an enema should be carried out to prevent superimposition of faecal material on the urinary tract; plain radiographs provide a check on the adequacy of this and also of the chosen radiographic exposure. They allow assessment of abdominal serosal detail, and hence will give an indication of the presence of urinary tract rupture. Plain radiographs will also demonstrate radiopaque calculi, and it is important to include the entire urinary tract in plain radiographic views so that the presence of calculi in the kidneys, ureters and along the urethra may be identified (Fig. 1).

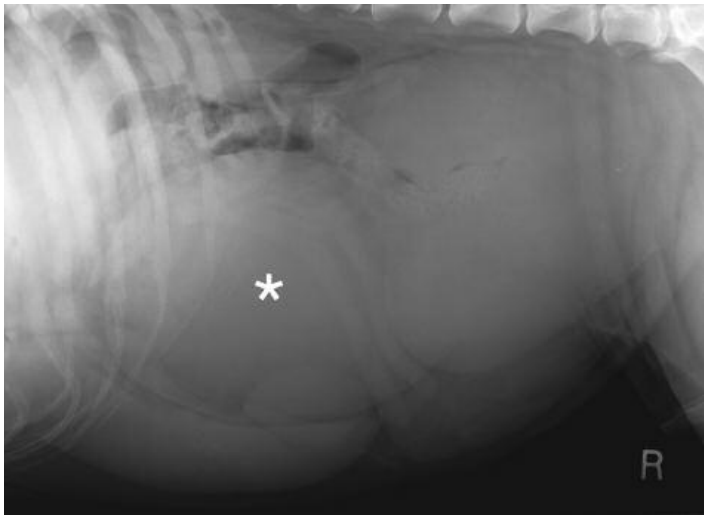

Fig. 2: *A lateral view of a dog with multilobulated paraprostatic cysts; these are the large well-defined soft tissue structures in the caudal abdomen, extending both dorsal and ventral to the descending colon and cranially displacing the bladder (starred).*

Fig. 3a: *A lateral view of the caudal abdomen of an eight-year-old male dog with stranguria and haematuria and shows ill-defined, irregular mineralisation in the region of the prostate and extending ventral to it. The prostate gland also has an ill-defined margin. This is suggestive of neoplasia, although prostatitis cannot be completely excluded.*

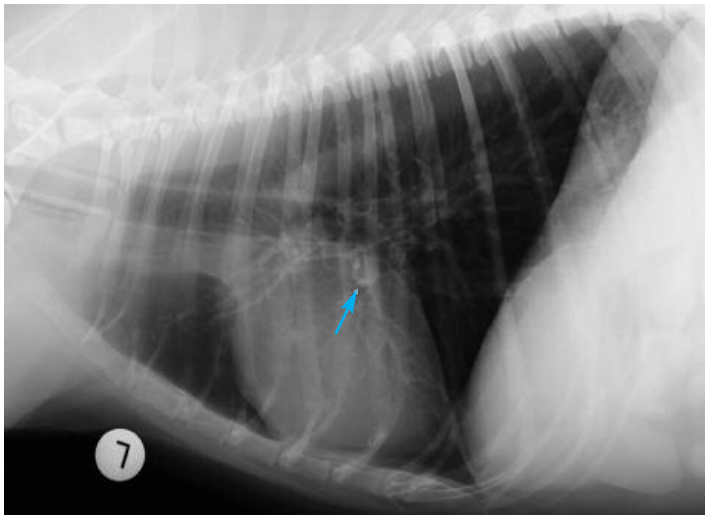

Fig. 3b: *A lateral view of the thorax of the same dog. A pulmonary nodule is present (arrow), consistent with metastatic neoplasia.*

Prostate

Prostatic size and radiopacity can also be assessed on plain radiographs. The prostatic size should not exceed 70% of the distance between the cranio-ventral sacrum and the pubic brim. Prostatic enlargement may be associated with benign prostatic hyperplasia, prostatic cysts, prostatitis or prostatic neoplasia. An ill-defined prostatic margin is more often present with an aggressive process such as neoplasia or prostatitis, than with benign processes such as cysts or benign prostatic hyperplasia. Prostatic mineralisation is most commonly associated with prostatic neoplasia, but may occasionally be associated with prostatitis and paraprostatic cysts.

Paraprostatic cysts are located outside the prostatic parenchyma, but connected to it by a stalk; these often appear as bladder-like structures in the caudal abdomen (Fig. 2). In such cases, a retrograde urethrogram may be required to determine the location of the bladder. The walls of paraprostatic cysts may mineralise, resulting in an eggshell-like appearance.

Prostatic neoplasia may also result in metastasis to the draining sub-lumbar lymph nodes, and to the lumbar or sacral vertebrae, causing irregular periosteal reaction along their ventral surfaces. Metastasis to the lungs also occurs, so inflated thoracic radiographs should also be taken if neoplasia is suspected (Figs. 3a and b).

CONTRAST RADIOGRAPHY

All contrast procedures should be carried out under general anaesthesia as they involve catheterising the bladder. This prevents patient discomfort and avoids trauma to the bladder and urethra.

Pneumocystography

This is a simple and cheap technique, which has limited uses. The bladder is catheterised, the urine removed and gas (usually room air) is slowly instilled into the bladder lumen until the bladder is clearly palpable, but not turgid (to avoid over-distension of the bladder). Bladder over-distension results in gas reflux along the ureters, so that gas is also found in the renal pelves. The gas may demonstrate large soft tissue masses within the bladder lumen and gross bladder wall thickening (Fig. 4), but small or subtle lesions are not usually visible with this technique.

Positive contrast cystography

The bladder is catheterised, emptied of urine and then filled with positive contrast; either ionic or non-ionic iodinated contrast media can be used, usually at a concentration of 120-400 mgI/ml. This technique tends to obscure bladder luminal pathology, but is often used to demonstrate the location of the bladder, and also, if bladder rupture is suspected, this method is superior to pneumocystography, as extravasated positive contrast tends to pool adjacent to the bladder, conversely

Fig. 4: *A pneumocystogram in a female dog; in this case, a large sessile soft tissue mass is delineated on the dorsal bladder wall.*

extravasated gas will tend to accumulate in the highest point of the abdomen (cranio-dorsally).

Double contrast pneumocystography

This technique involves a pneumocystogram with a small volume of iodinated positive contrast added to it; the volume added depends on bladder volume, but usually 1-2 ml of positive contrast is used in cats, and 3-5 ml in dogs. The bladder should be gently agitated so that positive contrast may coat any areas of mucosal ulceration, but usually only the dependent portion of the bladder can be assessed. The contrast forms a shallow pool on the dependent wall of the bladder, so that mural or luminal lesions will displace the contrast, causing a filling defect in the contrast pool, and so they become visible (Fig. 5). If non-adherent lesions are present, e.g. calculi, then these will be found in the dependent portion of the bladder and so in the centre of the contrast pool. Different projections, e.g. both lateral views and both dorsoventral and ventrodorsal views, may be required to delineate lesions adherent to the bladder wall, e.g. mural masses, as only the portion of wall covered by the contrast pool can be assessed. This technique is largely superseded by ultrasound, as a thorough and careful ultrasonographic assessment of the bladder is easier and quicker and may be more sensitive to small lesions.

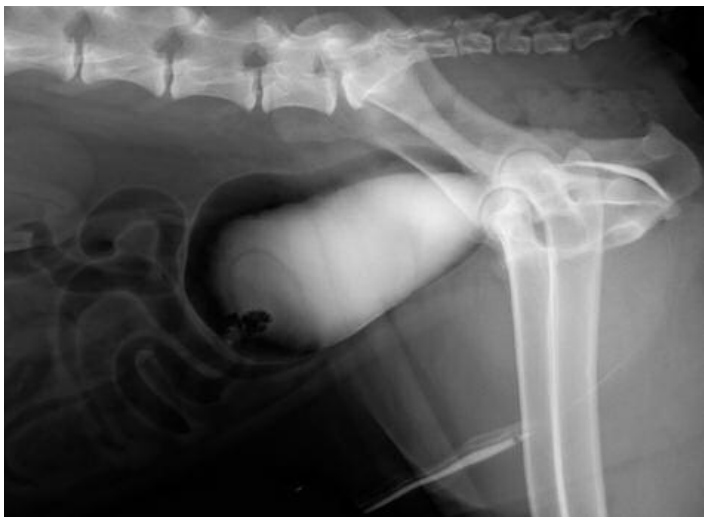

Fig. 5: *A double contrast cystogram in a male dog; a small, irregularly-margined mass is demonstrated at the cranio-ventral pole of the bladder.*

Retrograde urethrography/vaginourethrography

This is the technique of choice for evaluating the urethra and is useful to evaluate mural pathology, e.g. strictures or mucosal irregularity, associated with neoplasia or inflammation, luminal pathology, e.g. calculi, particularly those which are radiolucent, and urethral rupture, e.g. secondary to trauma or neoplasia.

Urethrogram

A retrograde urethrogram is usually carried out in male dogs; a dog urinary catheter of as wide a gauge as can be inserted easily is pre-filled with contrast (to prevent air bubbles) and placed in the distal urethra; the tip of the penis and prepuce are then carefully clamped with atraumatic forceps to provide a seal (Fig. 6). Positive contrast ionic or non-ionic iodinated contrast medium is instilled at an approximate volume of 10-15 ml, with the exposure made towards the end of injection. Extension tubing should pre-filled with contrast and attached to the end of the catheter so that the person injecting can be as far from the primary beam as possible, and protective lead clothing should be worn.

Fig. 6: *A normal retrograde urethrogram in a male dog. The smooth urethral narrowing at the level of the prostate is a normal finding. As the contrast reaches the bladder, it mixes with the urine in the bladder lumen, often resulting in odd swirling contrast patterns. This precludes accurate assessment of the bladder.*

Fig. 7: *A retrograde vaginourethrogram in a nine-year-old female dog with stranguria. The urethral contrast column shows marked margin irregularity with small spicular areas of extravasation (arrows). This could be consistent with either urethral neoplasia or granulomatous urethritis; in this case, a catheter suction biopsy revealed transitional cell carcinoma. Stars show the normal vagina filled with contrast.*

Vaginourethrogram

In the bitch, retrograde vaginourethrography is usually performed (Fig. 7); a Foley catheter is placed in the vulva, with the balloon inflated just inside the vulval lips, which are closed around it with atraumatic forceps. Iodinated contrast at approximately 1 ml/kg is instilled to fill the vagina and this is usually sufficient to overflow and fill the urethra. Care should be taken that the catheter does not obstruct the urethral opening, and often the tip of the catheter is removed to help prevent this. As in the male, the catheter should be pre-filled with contrast, and the exposure made during the end of injection with attention to radiation safety.

FURTHER READING

BARR, F. J. and KIRBERGER, R. M. (2009) BSAVA Manual of Canine and Feline Abdominal Imaging. BSAVA, Cheltenham.

NELSON, R. W. and GUILLERMO COUTO, C. (2008) Small Animal Internal Medicine. Mosby.

THRALL, D. E. (2007) Textbook of Veterinary Diagnostic Radiology. Saunders.

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These multiple choice questions are based on the above text. Answers appear on page 59.

1. **What volume of air should be used in a pneumocystogram:**
   a. 1 ml/kg
   b. 10-15 ml
   c. Sufficient to mildly distend the bladder on palpation
   d. The volume of urine removed from the bladder.

2. **What is the best method to image the whole urethra:**
   a. Retrograde urethrography
   b. Ultrasonography
   c. Double contrast cystography
   d. Plain radiography

2. **What is the best method to diagnose bladder rupture:**
   a. Ultrasonography
   b. Plain radiography
   c. Double contrast cystography
   d. Positive contrast cystography