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Haematuria – a clinical sign in dogs

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Summary

Haematuria is one of the reasons why dog owners visit the vet's surgery. Given the increasing number of clinical cases presenting symptoms of haematuria, it was decided to analyze the causes of this condition in dogs and evaluate them. The aim of the study was to present the most common diseases of the canine urogenital system in the Lublin region in which haematuria is present, and to assess the usefulness of imaging diagnostics in dogs with symptoms of haematuria and the effectiveness of treatment for selected urogenital diseases based on these findings. The study found that the most common cause of haematuria in the 53 dogs examined was prostate cysts, which were found in 22 male dogs. The second group of dogs with haematuria comprised 21 dogs with cystitis, 15 females and 6 males, while in 10 cases the cause of haematuria was urinary stones, with 5 males and 5 females affected.

Keywords: haematuria, prostatic cysts, cystitis, urinary stones

One reason dog owners visit the veterinary clinic is the observed reddish discolouration of urine, which is often the first visible sign of disease.

A laboratory urine analysis is an important part of the diagnostic process, and can be performed at the veterinary clinic (38). This is a significant test that enables assessment of the physical and chemical properties of urine (1). It allows a veterinarian to assess the functioning of the animal's urinary system, and is also essential for diagnosing metabolic diseases (1, 4). Haematuria is defined as the presence of blood or red blood cells in the urine (23), which may indicate a pathological process most commonly involving the urinary tract (5). The presence of blood or blood cells in the urine colours it red to reddish-brown (24). Blood entering the urine may originate from the kidneys, ureters, urethra or bladder. In males, haematuria may be caused by prostate conditions (7). Frequently, the causes of haematuria include bladder infections, tumours or injuries, and urinary stones (26).

Cystitisis is a medical condition characterised by haematuria, chronic inflammation and infection of the bladder. This condition often features polypoid lesions distributed across the bladder mucosa. These lesions can cause ulcers in the bladder mucosa, leading to sporadic blood in the urine (22). Inflammation is typically caused by bacterial infections of the bladder (35). Cystitis usually causes discomfort and pain in dogs. Straining when urinating is often observed. The volume of urine passed is usually small, and urination occurs much more frequently than usual, with the urine being discoloured with blood (34). Another cause of haematuria is urolithiasis, a condition with multiple underlying causes (20). Urolithiasis is a common condition, particularly in dogs (14, 29), and is common in companion animals. The condition involves the formation of stones in the bladder. Urinary stones form when mineral compounds aggregate into a compact mass around exfoliated epithelium or bacteria, which form the organic nucleus of the stone. There are two most common types of urinary stones in dogs: struvite stones and calcium oxalate stones (8). Some dogs with blood in their urine suffer from a prostatic condition (16). The most common prostate disorders in dogs

include: benign prostatic hyperplasia, prostatitis, prostate cysts and prostate tumours (18, 25, 27). The most commonly diagnosed prostate condition in dogs is prostatic cysts, which contribute to the enlargement of the prostate gland, lead to haematuria, and sometimes also to difficulty in defecation. There are two main types of prostatic cysts in dogs: paraprostatic cysts around the gland and cavitating cysts on the gland itself. Neither of these cyst types is a neoplastic lesion (21, 37).

In view of the increasing number of clinical cases with haematuria, it was decided to analyse and evaluate the causes of this condition in dogs.

The aim of the study was to present the most common genitourinary diseases in the canine population of the Lublin region that are present with haematuria, and to assess the usefulness of imaging diagnostics in dogs with haematuria, as well as the effectiveness of treatment for selected genitourinary diseases based on the results obtained.

Tab. 1. Causes of haematuria in the present study (53 dogs)

Breed	Number of dogs	Average age (in years)	Sex	Examination	Condition
English Bulldog	3	5	Males	Ultrasound imaging	Cystitis
English Bulldog	1	6	Female	Ultrasound imaging	Cystitis
English Bulldog	1	10 months	Male	Ultrasound imaging	Prostatic cysts
French Bulldog	1	12	Male	Ultrasound imaging	Prostatic cysts
Spaniel	3	10	Females	Ultrasound imaging	Cystitis
Spaniel	1	9	Male	Ultrasound imaging	Cystitis
Spaniel	1	9	Male	Ultrasound imaging	Prostatic cysts
Spaniel	1	14	Female	Ultrasound imaging	Urinary stones
Yorkshire Terrier	1	4.5	Female	Ultrasound imaging	Cystitis
Yorkshire Terrier	1	8	Male	Ultrasound/X-ray imaging	Urinary stones
Akita Inu	1	2	Female	Ultrasound imaging	Cystitis
Crossbreed	2	8.5	Males	Ultrasound imaging	Cystitis
Crossbreed	5	11	Females	Ultrasound imaging	Cystitis
Crossbreed	2	11	Males	Ultrasound imaging	Urinary stones
Crossbreed	3	5	Females	Ultrasound imaging	Urinary stones
Crossbreed	10	10.9	Males	Ultrasound/X-ray imaging	Prostatic cysts
Beagle	1	13	Male	Ultrasound imaging	Urinary stones
Beagle	1	10	Female	Ultrasound imaging	Urinary stones
Cavalier King Charles Spaniel	1	11	Female	Ultrasound imaging	Urinary stones
Dachshund	1	9	Male	Ultrasound imaging	Urinary stones
Shih Tzu	1	14	Male	Ultrasound imaging	Prostatic cysts
Foxtender	1	17	Male	Ultrasound imaging	Prostatic cysts
Welshougle	1	11	Male	Ultrasound imaging	Prostatic cysts
Welshougle	1	14	Female	Ultrasound imaging	Cystitis
German Spaniel	1	6	Male	Ultrasound imaging	Prostatic cysts
Labrador	1	3	Male	Ultrasound imaging	Prostatic cysts
Labrador	2	10	Females	Ultrasound imaging	Cystitis
Shepherd Dog	2	5	Males	Ultrasound imaging	Prostatic cysts
AmStaff	1	6	Male	Ultrasound imaging	Prostatic cysts
AmStaff	1	3 months	Female	Ultrasound imaging	Cystitis

Material and methods

The study involved animal patients of the University of Life Sciences in Lublin presenting with haematuria (53 dogs: 22 crossbreeds, 5 English Bulldogs, 1 French Bulldog, 6 Spaniels, 2 Yorkshire Terriers, 1 Akita Inu, 2 Beagles, 1 Cavalier King Charles Spaniel, 1 Dachshund, 1 Shih Tzu, 1 Foxtender, 2 Welshougle, 1 German Spaniel, 3 Labradors, 2 Shepherd Dogs, and 2 AmStaffs).

The study group comprised 20 females and 33 males (Tab. 1).

When urinary tract abnormalities were suspected, the dogs were referred for ultrasound and X-ray imaging. The animals were appropriately prepared for the examinations. Where possible, the animals had a full bladder, and in dogs with fur that would interfere with the examination, the lower abdomen was shaved.

The results of the imaging examination were analysed and summarised in Tables 1 and 2.

Tab. 2. Number of urinary tract disorder cases by sex

	Total	Females	Males
Urinary stones	10	5	5
Cystitis	21	15	6
Prostatic cysts	22	0	22

Results and discussion

The present study was conducted on 53 dogs with a medical history of blood in their urine. The dogs underwent a clinical examination and were referred for abdominal X-ray or ultrasound imaging. The causes of haematuria and the animals' sex are provided in Table 2.

The results of the study show that the most common cause of haematuria in the 53 dogs examined was prostate cysts, which were diagnosed in 22 male dogs. The second group of dogs with haematuria comprised 21 dogs with cystitis (15 females and 6 males), while

in 10 cases, the cause of haematuria was urinary stones (5 males and 5 females).

The findings of a properly conducted history-taking and a thorough clinical examination often help to narrow down the diagnosis. Additional diagnostic assessment, including laboratory tests (urinalysis, urine culture [antibiogram]) and diagnostic imaging (abdominal radiographs, ultrasound), as well as tissue sampling for cytological or histopathological evaluation, may be useful for identifying the cause (11).

Ultrasound is the most commonly used imaging modality for the diagnosis of patients with haematuria or dysuria. An ultrasound scan provides information on the urinary tract, including bladder capacity, changes in the bladder contour, changes in the bladder wall thickness, identification of wall-associated and intraluminal masses, and identification of external changes that may displace the bladder wall, causing changes in its shape, assessment of the urinary tract and lymph nodes, and abnormalities involving the prostate gland (2).

X-ray examination, on the other hand, is among the most commonly used diagnostic tools in veterinary practice (15). X-rays enable an examination of an animal's internal organs and reveal changes that may not be visible to the unaided eye. Thanks to such an image, it is possible to detect tumours, bone fractures, pregnancy, foreign bodies, enlarged organs, urinary stones and many other conditions. There is no need to specially prepare animals for an X-ray examination. If a dog is restless or in pain, sedation may be required to ensure a clear X-ray image (31).

Bladder stones in dogs can cause blood in the urine and painful urination. Haematuria occurs because the stones mechanically irritate the bladder mucosa, damaging the capillaries. Dysuria may be due to inflammation, swelling and tenderness of the bladder wall associated with contractions of the muscular layer. Dysuria, or dribbling urination, may result from a physical obstruction to the flow of urine when a stone is located in the bladder neck. Large stones usually act as a blockage, causing partial obstruction of the bladder neck (12).

When symptoms suggest bladder stones, an X-ray is usually the initial diagnostic test. Most types of stones are clearly visible on an X-ray. Another commonly used diagnostic method for detecting urinary stones is an ultrasound scan (21). Some large stones can be detected by a veterinarian by palpation. Cystoscopy is a diagnostic method that involves inserting an endoscope into the bladder to visually assess its contents and the condition of its mucous membrane, and to potentially remove the stone. Dogs diagnosed with bladder stones were treated surgically. In each case of urinary stone disease, the animal's owners were informed of the possibility of determining the origin of the stone, which would enable the appropriate selection of diet and the prevention or reduction of recurrence (19).

In the literature, authors describe three main methods for treating bladder stones: surgical removal of urinary stones, non-surgical removal using urohydropropulsion, and stone dissolution using appropriate commercial stone-dissolving feed. The choice of the treatment method is determined by the type of urinary stone present and the owner's preferences (12). Struvite and uric acid stones can be dissolved with dietary changes and medication. Calcium oxalate stones cannot be dissolved with dietary changes alone and must be removed surgically. Bladder stones can be removed surgically via cystotomy, i.e. making a small incision in the bladder to extract the stones (29). Small stones in female dogs can be removed using urohydropropulsion. This procedure is performed under anaesthesia by filling the bladder with saline solution through the urethra (36). A method of treatment for all types of urinary stone disease, used and recommended by some authors, is to increase the animal's water intake. Increasing the amount of water that the animal consumes each day dilutes the urine or reduces the concentration of urinary stone precursors. Another strategy that can be employed when feeding wet food is impractical is the use of salt. Increasing dietary salt intake can increase thirst and prompt the animal to drink more water (6, 30).

A history of blood in the urine, straining during urination, and a more frequent urge to urinate than usual are characteristic symptoms of cystitis. Palpation of the abdomen reveals a considerably distended and tender urinary bladder. To confirm the initial suspicion, the following tests are recommended: haematological tests, urinalysis, and urine culture (30). Clinical examination demonstrates abdominal pain on palpation, associated with considerable bladder distension, a slightly increased body temperature, and an increased respiratory rate. A complete blood count shows a significant decrease in Hb, red blood cells and MCHC and a significant increase in total leukocyte count (TLC) with a significant reduction in segmented neutrophils. Biochemical analysis shows no changes in the urea, creatinine and uric acid levels. Macroscopic examination of the urine shows cloudy urine with blood, while microscopic examination shows an increased number of white and red blood cells, bacteria and uric acid crystals. Urine culture shows numerous bacteria, with *Escherichia coli*, *Proteus* and *Staphylococcus* being the most commonly found in cases of cystitis. Examination of the bladder shows thickening of the bladder wall with hyperechoic layers (28). Most dogs with cystitis respond well to antibiotic treatment. Urine samples are used for culturing and sensitivity testing, enabling selection of the most effective antibiotic (3). In the early stages of treatment for many cases of cystitis, some authors recommend the use of analgesics or anti-inflammatory drugs to relieve the discomfort of urination. Patients are advised to increase their water intake or adopt a high-fluid diet, as this facilitates and accelerates the removal of bacteria and post-inflammatory tissue remnants (36). Females are more prone to cystitis than males due to anatomical factors and the location of the urethra.

Cystitis is more commonly diagnosed in older female dogs, but it can also occur in young puppies, although the condition can affect dogs of any age and sex. Cystitis may be accompanied by certain conditions, including diabetes, kidney diseases, hyperadrenocorticism, Cushing's disease, bladder cancer, urinary incontinence and immunosuppression. Dogs with bladder stones are also more prone to recurrent cystitis (11).

The dogs included in the present study were referred to the radiology department after a detailed history-taking session regarding the course and duration of the disease, co-existing conditions, and a clinical examination. X-ray and ultrasound examinations allowed a diagnosis to be made and treatment to be started.

The treatment involved broad-spectrum antibiotic therapy. Additionally, non-steroidal anti-inflammatory drugs were administered for five days or longer. Most of the treated dogs recovered after five days. Haematuria, the symptom of the disease most concerning to the owner, subsided, and the frequency and volume of urination returned to levels seen before the illness. In two cases, the symptoms of polyuria and haematuria recurred within two weeks, and it was decided to collect a urine sample for culture and perform an antibiotic susceptibility test. Targeted treatment in these cases led to permanent symptom resolution. According to the authors, this diagnostic and therapeutic approach is appropriate because it prevents unnecessary diagnostic procedures and associated costs.

Another group of dogs (22 males) with haematuria comprised dogs with prostate diseases.

The typical history for prostate cysts involves male dogs, usually over six years of age, exhibiting urinary tract symptoms, including haematuria, polyuria, painful urination and straining during urination. Some dogs with a prostate disease may exhibit a wide-based pelvic limb gait, commonly referred to as the "prostatic shuffle". In breeding dogs, reduced libido, haemospermia and reduced fertility are sometimes observed (12).

If the history, clinical examination and rectal palpation indicate a prostate disease, the following may be performed to make an aetiological diagnosis: radiography and contrast imaging, ultrasound scan, cytological assessment, bacterial culture of urine, prostatic fluid and semen, fine-needle aspiration cytology of the prostate and prostate biopsy (13).

Prostatitis in dogs is usually purulent, and acute prostatitis can lead to abscess formation. Prostatitis is usually caused by various bacteria, including *Escherichia coli*, *Staphylococcus*, *Streptococcus* and *Mycoplasma* spp. The infection may be haematogenous or originate from the urethra (17).

Acute prostatitis is associated with malaise, lethargy, reduced appetite, a tendency to lie down, pain in the hindquarter region, and an elevated body temperature. In severe cases, dehydration, sepsis and shock may occur. In such cases, blood tests reveal neutrophilia (10). Abdominal X-rays help assess the size and location of the prostate gland and identify metastatic neoplasms, enlarged sublumbar lymph nodes, prostatic mineralisation and signs of localised peritonitis. An abdominal ultrasound scan is an essential diagnostic test for the prostate in dogs. Using this method enables assessment of cysts and abscesses, gland size, echogenic texture, and changes suggesting BPH or neoplasm. Contrast radiography is very helpful in cases of prostate disease. A sign of prostate disease may be excessive backflow of contrast medium from the urethra into the prostate tissue. Paraprostatic cysts can be identified on contrast radiography, allowing accurate determination of the bladder's position relative to the cysts (12).

For several years, the diagnosis of prostate diseases in dogs has focused on identifying markers that are used in the diagnosis of prostate diseases in humans. The markers used for diagnosis are prostate-specific antigen (PSA) and acid phosphatase (AcP). In 1984, Chapdelaine et al. demonstrated that canine prostate-specific arginine esterase (CPSE) is the most reliable marker of canine prostate secretion. However, in 1995, Bell et al. found higher serum CPSE concentrations in dogs suffering from a prostate disease than in healthy dogs. A new commercial test based on an ELISA-type immunological method has been developed, enabling BPH diagnosis from a blood sample. Two studies have demonstrated that this test is reliable, as it has been shown to be 97.1% sensitive, 92.1% specific, and to exhibit high reproducibility, with intra-assay and inter-assay coefficients of variation of $< 3.1\%$ and $< 6.7\%$, respectively (33).

Depending on the type of prostate disease, various treatment methods may be employed. In the acute phase of prostatitis, which is associated with dehydration or shock, intravenous fluid therapy is advisable. As the blood-prostate barrier remains disrupted, antibiotics should be selected based on susceptibility tests and administered for 3-4 weeks. Enrofloxacin at a dose of 5 mg/kg twice daily, administered orally, is the drug of choice while awaiting microbiological test results and an antibiogram. Large prostate abscesses are preferably treated using surgical drainage (40).

The author's treatment method. One of the methods of treating prostate cysts in dogs is surgical drainage or removal of the cysts. Cysts should not be left untreated due to the high risk of rupture, which can lead to infection and general deterioration in health. Depending on the cyst's size and location, the veterinarian may perform cyst drainage using a needle under ultrasound guidance. In this way, small punctures will be made to drain the cysts. Where cysts are located in hard-to-reach areas of the prostate, a laparotomy may be employed to remove the cysts in their entirety without prior drainage (37). The most commonly used method of treating prostate diseases is castration. In the case of castration, prostate involution is usually visible within a few weeks, and complete recovery occurs within a few months. However, in males intended for breeding, pharmacological therapy with finasteride is effective. Finasteride blocks the action of 5-alpha-

reductase, the enzyme that converts testosterone into dihydrotestosterone. Dihydrotestosterone is a biologically active hormone that promotes prostate enlargement in dogs. Administration of finasteride at a dose of 1 mg/kg/day orally for 16-21 weeks will reduce prostate enlargement by 50-70%. A lower dose of 0.1 mg/kg/day reduces prostatic volume by 43%, resolves clinical signs, decreases dihydrotestosterone concentrations by 58%, and maintains normal testosterone levels. It does not affect semen quality, fertility or libido. It should be noted that prostate hypertrophy often recurs after finasteride treatment is completed.

Osaterone acetate is available in Europe as a testosterone analogue with potent antiandrogenic activity. Ozaterone, administered at 0.25 mg/kg orally once daily, resulted in the resolution of clinical symptoms in approximately 50% of dogs within 14 days. Semen quality and fertility were not impaired and, in some cases, may have improved.

A subcutaneous implant containing the GnRH agonist deslorelin is available in Europe, Australia, and New Zealand and is approved for reversible castration of male dogs. Without testosterone, dihydrotestosterone cannot be produced, and the prostate gland volume is reduced by 60%. Deslorelin should be administered every 6-12 months, depending on the formulation used. Unlike finasteride and ozaterone, spermatogenesis and fertility are suppressed during the active period of the implant (9).

According to the authors, castration is a highly effective treatment for prostate cysts, as it involves no recurrences or other complications described above. It provides good results in dogs of all ages. Radiological diagnosis is sufficient to make a diagnosis, supplementing data from medical history and clinical examination. In cases of doubt regarding the radiological diagnosis of the type of prostate disease and the choice of treatment, the authors supplemented the examination with microscopic analysis of prostate secretions. Prostate secretions are collected using a catheter inserted into the urethra at the level of the prostate, guided by digital rectal palpation. Using a syringe connected to the catheter in this position, a small amount of prostate secretion is collected for the pathologist to assess and make a diagnosis. If no neoplastic cells are present in the examined secretion, castration is sufficient for the complete cure of the prostate cyst.

The present study indicates that ultrasound or X-ray examinations are essential for the proper treatment of genitourinary disorders accompanied by haematuria. Initiating treatment based solely on clinical examination and additional laboratory tests without imaging is difficult, and the effectiveness of such treatment may be questionable. Performing an ultrasound or X-ray examination confirms the preliminary diagnosis based on clinical examination and additional laboratory tests, thereby enabling the selection of an appropriate treatment method for the specific condition.

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