

INTRODUCTION

Hematuria is defined as the presence of whole blood in urine. The owner usually presents their pet to the veterinarian because they have observed red or brown urine. Urine normally contains fibrinolysins to prevent the formation of blood clots, which could obstruct the ureters or urethra. The presence of blood clots in the urine indicates hemorrhage severe enough to overwhelm this protective mechanism. In addition, in some animals, significant hematuria may be diagnosed after microscopic evaluation of urine that looks grossly clear. In these instances, the client may report that the red urine is intermittent, or resolved when microscopic hematuria persists. Hematuria should be differentiated from other causes of red urine, such as hemoglobinuria or the ingested plant pigments (e.g., beets) or injected dyes (e.g., phenolphthalein, phenazopyridine).

Systemic causes of bleeding should be considered when other sites of bleeding are noted, or if other causes of urinary tract bleeding are ruled out. Ischemia can also result in hemorrhage. Infarction of the kidney secondary to disseminated intravascular coagulation of any cause (e.g., heat stroke *p. 417*), or secondary to septic emboli as in bacterial endocarditis, is the most commonly described cause of ischemia. Organ specific hematuria can result from neoplasia, urolithiasis, infection, parasitism (*Dioctophyma renal*, *Capillaria plica*), or drugs (e.g., cyclophosphamide). Chronic passive congestion of the kidneys from any cause has also been associated with mild hematuria.

The most common cause of hematuria in cats is variably known as feline urologic syndrome, idiopathic hematuria of the lower urinary tract, or interstitial cystitis. In dogs “benign essential hematuria” is defined as renal bleeding in which no pathologic process can be identified.

Hematuria is rarely life-threatening except in instances of massive bleeding leading to hemorrhagic shock or when large blood clots in the bladder obstruct urine outflow.

DIAGNOSIS

History/Signalment

In Welsh corgis, hematuria is the most common clinical finding in telangiectasia of the kidneys. Geriatric animals may be more prone to neoplastic disorders. Neoplasia can affect kidneys, ureters, bladder, urethra, or prostate gland and hematuria may be the primary problem noted.

Two clinical questions need to be answered: where is the blood from and what is the cause?

An accurate observation of when blood occurs in the urine stream can be extremely helpful in localization (Fig. 1). Question the owner as to when blood is most frequently observed:

- If the blood is consistently noted at the beginning of urination or independent of urination, then the most likely source is the urethra, the prostate gland in males, or the reproductive tract in females. Primary urethral diseases are fairly uncommon except for neoplasia in the old dog and urethral urolithiasis in males.
- If the blood is consistently at the end of urination, the bladder is the most likely origin.
- If the blood is throughout urination, the origin may be kidney(s), ureter(s), bladder, or prostate gland.
- If dysuria is an accompanying sign, the lower urinary tract and prostate gland are the most likely. An exception to this is that passage of large blood clots of renal origin may cause dysuria.
- If blood is associated with strenuous exercise, then it may be transient.

Question the owner as to whether the animal has any other sites of bleeding, suggesting a coagulopathy.

A free roaming dog may ingest a rodenticide with subsequent coagulopathy, or have experienced a traumatic event. Any urinary tract organ can be traumatized resulting in bleeding, particularly with blunt abdominal trauma. However, animals with urologic injury do not always have hematuria.

Recent treatment with cyclophosphamide may cause hematuria (*see Oncological Emergencies p. 443/447–448*).

Clinical Signs/Physical Examination

- The kidneys should be checked for size, shape, consistency, and symmetry.
- The bladder should be carefully palpated for wall thickness and the presence of calculi (*see Urethral Obstruction p. 745*).
- The prostate gland should be palpated rectally in male dogs (*see Prostatic Disease p. 742*). In cystic prostatic hyperplasia, increased prostatic vascularity may result in prostatic bleeding into the urethra.
- The prepuce should be examined for bleeding in males (*p. 736/740*) and the vagina in females (*p. 759*).
- The animal should be examined for other sites of bleeding (*see Toxicological Emergencies p. 638, Thrombocytopenia p. 451, Hemorrhage p. 619*). Clipping the hair of the abdomen and perineum allows thorough visual examination of the skin.
- A painful lumbar mass or bruise suggests possible renal trauma.
- Urine extravasation from a damaged urethra may cause perineal, scrotal, or preputial discoloration and swelling. If urine extravasation continues, necrosis and sloughing of the skin can occur (*see Urine Leakage p. 727–728*).

Laboratory Evaluation/Diagnostic Imaging

Stat

- **PCV, TS** should be performed to note severity of blood loss. Note colour of plasma; if free hemoglobin is present it will color the plasma pink.
- **ACT, PT/PTT** should be performed where possible to rule out a coagulopathy.
- **BUN, Serum creatinine** must be performed to further localize the lesion; increased values suggest a renal origin, or a post-renal problem such as obstruction (*p. 745*) or rupture (*p. 728*).
- **Urinalysis.** If urinalysis cannot be conducted immediately, urine should be refrigerated until examined, preferably within a few hours. Cystocentesis, catheterization, and manual expression can result in **iatrogenic trauma** and mild hemorrhage. To avoid this, urinalysis is first performed on a voided urine sample and then on a cystocentesis sample. If blood is present in a voided, but not a cystocentesis sample, diseases of the distal urethra, prepuce or prostate in the male, or vagina and uterus in the female, are potential sites. If blood is present in urine from both the voiding and cystocentesis samples, the origin must be kidney(s), ureter(s), bladder, or proximal urethra. Blood from the prostate may appear in both voiding and cystocentesis samples because of reflux of hemorrhagic prostatic fluid into the bladder or leakage into the urethra. A complete urinalysis should always be performed. The presence of RBC casts indicates renal bleeding, but they are uncommonly seen and their absence does not exclude a renal origin. Complete urinalysis will determine whether inflammation exists (pyuria), and whether it is associated with infection (bacteruria) or parasitism (parasite eggs). A marked proteinuria is suggestive of glomerular disease.
- If the **occult blood reaction** is positive, but **RBCs are not present** in the urine, there are three major possibilities:
 - Hemoglobinuria with or without hemoglobinemia. If the plasma is hemolyzed, hemoglobinuria is caused by hemoglobinemia. When intravascular hemolysis releases hemoglobin, circulating haptoglobin rapidly binds the hemoglobin. The hemoglobin-haptoglobin complex is too large to be filtered through the glomerulus and is cleared by the reticuloendothelial system. However, if the haptoglobin binding system becomes saturated, free hemoglobin will be present in the plasma and is filtered by the glomerulus, resulting in hemoglobinuria.
 - If there is no evidence for hemoglobinemia, hemoglobinuria may be secondary to the complete lysis of red blood cells in urine. Red blood cells may lyse in dilute or aged urine, thus it is important that urine be examined soon after collection. In a voided sample, contamination with blood from an external source, such as dissolution of flea dirt, may be the source of the hemoglobin in the urine.
 - Myoglobinuria will also result in a positive occult blood reaction with no red blood cells in the urine sediment. Myoglobin is relatively small and is rapidly cleared through glomeruli without altering plasma color. Myoglobin gives more of a brown than red color to urine, but blood in urine is also often brown. With myoglobinuria, there should be clinical evidence of active muscle disease or injury. An **ammonium sulphate precipitation test** can be used to distinguish hemoglobinuria from myoglobinuria.
- Both the occult blood reaction and the urine sediment examination for red blood cells are negative for ingested or injected dyes.
- **Urine culture** is necessary to identify an infectious cause.
- In a **semen** sample from a dog with hematuria, hemorrhage suggests prostatic (*p. 742*), testicular, or epididymal origin (*p. 739*). The prostate is directly connected to the urinary tract, thus worsening hemorrhage after prostatic massage helps identify the prostate as the source of the hematuria.
- **Survey radiographs** of the abdomen may reveal enlargement and increased density of the retroperitoneal space following disruption of kidneys or ureters or may reveal radiopaque uroliths.

Extended Laboratory Data Base

- **CBC.** Leukocytosis is more common with acute inflammatory diseases or abscessation of the kidneys and prostate gland, than with bladder diseases or chronic inflammation anywhere in the urinary tract. Thrombocytopenia may cause hematuria.
- Platelet function (bleeding time), PT/PTT, thrombin time, Von Willebrand's Disease, and fibrinolysis (fibrin degradation products, fibrinogen) may need to be performed to confirm a coagulopathy as a cause of hematuria.
- **Imaging.** The type of imaging study is based on the most probable site of origin as determined by history and physical examination (Fig. 1).
 - **Ultrasonographic examination** can detect abnormalities in shape, size, and texture of any of the urinary organs and prostate and is useful for identifying radiopaque and radioluscent uroliths. Should 'masses' be identified within the bladder, a biopsy should be obtained as polyploid cystitis may be mistaken for neoplasia based on gross appearance; imaging results should be differentiated by histologic examination. For increased echogenicity, suggestive of inflammation, within the kidney, a renal biopsy should be obtained as autoimmune glomerular diseases have also been associated with hematuria.
 - **Excretory urography.** The excretory urogram is useful in detecting ureteral injury, ureteroliths, and neoplasia of the kidney and ureters. In a traumatized animal, the animal should be rehydrated and normotensive before excretory urography because radiographic contrast material can produce hypotension and bradycardia.
 - If **urethral damage** is suspected, a **retrograde urethrogram** is performed prior to cystogram if this is also being considered. If the urethral injury is confirmed, an excretory urogram is done instead of a retrograde cystogram, to avoid catheterizing the injured urethra.
 - **Bladder tears** are best delineated by positive **contrast cystography**. **Bladder masses** can be delineated with a **double-contrast cystogram**.
 - **Cystoscopy and urethroscopy** are particularly useful for identifying urethral and bladder masses and uroliths.
 - **Renal scintigraphy** is recommended to evaluate the renal function of the opposite kidney if the clinician is considering nephrectomy because of severe renal bleeding (i.e., causing severe anemia).

MANAGEMENT

The key to managing hematuria is to identify the location and predisposing cause. Treatment plans for all possible causes of hematuria are beyond the scope of this chapter, however, the following should be noted:

- A. Hematuria after a **traumatic event** is not an indication for immediate surgery. Shock (*p. 606*), respiratory distress (*p. 563*), and severe hemorrhage (*p. 625*) are managed first. The animal should be kept quiet in a cage, and its vital signs, clinical status, and hematocrit serially monitored (*p. 17/621*) until the urine grossly clears of blood. If the hematuria persists, further diagnostic tests are needed. Of course, deterioration of clinical status or hematocrit necessitates re-evaluation.
- B. In dogs with **idiopathic renal bleeding**, blood clots may form in the bladder and if large enough can cause dysuria and even obstruction. If a ventral cystotomy is required to remove the blood clots, the ureteral openings should be examined closely to determine which kidney is bleeding. A biopsy of the affected kidney is submitted for light and electron microscopic and immunofluorescent examination to try to identify a cause of the bleeding. Nephrectomy is not performed unless the opposite kidney is healthy and the bleeding is intractable.

SUGGESTED READING

1. Forrester SD. Diagnostic approach to hematuria in dogs and cats. *Vet Clin North Am Small Anim Pract*; 2004; 34(4):849-66.
2. Hawthorne JC, deHaan JJ, Goring RL, et al. Recurrent urethral obstruction secondary to idiopathic renal hematuria in a puppy. *J Am Anim Hosp Assoc*; 1998; 34(6):511-4.
3. Read RA, Bryden S. Urethral bleeding as a presenting sign of benign prostatic hyperplasia in the dog: a retrospective study (1979-1993). *J Am Anim Hosp Assoc*; 1995; 31(3):261-7.
4. Stone EA, DeNovo RC, Rawlings CA. Massive hematuria of nontraumatic renal origin in dogs. *J Am Vet Med Assoc*; 1983; 183(8):868-71.

FIGURE 1. Lesion Localization for Hematuria.



