

# Urinalysis

Urinalysis is a quick and relatively inexpensive test, the results of which are useful in a variety of situations not limited to those directly involving the urinary tract. Routine urinalysis is an essential part of the diagnostic evaluation of sick patients and the results should be interpreted along with the results of a chemistry panel. Ideally, urine should always be collected at the same time as blood for haematology and clinical chemistry AND before any treatment (including intravenous fluids) is administered. Complete interpretation of results of chemistry panels cannot be performed without concurrent knowledge of the urinalysis, particularly if there are abnormalities in renal (e.g. urea nitrogen and creatinine) or acid-base parameters on the chemistry panel. Similarly, interpretation of some abnormalities in urine (e.g. glucosuria, ketonuria) is facilitated by concurrent knowledge of chemistry results.

## Materials required:

Dipsticks / refractometer / centrifuge / microscope slides\* / cover-slips\* / microscope / plastic pipette

*\* Can be obtained from Awanui Veterinary using our or online ordering*

## How to:

1. Visual inspection – note the method of collection, volume, colour and turbidity of the sample. Urine volume directly affects the semi-quantitative sediment results. Colour and turbidity should be made on the well mixed sample.
2. Urine specific gravity (USG) – this is a measure of the urine concentrating ability of the animal. The USG should be read on the refractometer using the urine supernatant.
3. Dipstick analysis - dipsticks consist of various pads containing chemical ingredients which provide a colour change when a particular analyte is present in urine. This colour change is converted to a semi-quantitative result for the analyte in question. The dipstick analysis is usually performed on uncentrifuged urine, unless there is marked haematuria (which may affect interpretation of the colour changes on the dipstick). In urines with marked haematuria, the interfering erythrocytes can be sedimented by centrifugation and the dipstick analysis can be performed on the supernatant. When using, follow manufacturer's directions on storage and use of the reagents.
4. Sediment examination – a standard volume of urine (ideally 4-5mL) is centrifuged at low speed (1000 -2000rpm). The supernatant is decanted after USG measurement (and dipstick if required) and the urine is gently resuspended in approximately 0.3-0.5mL urine. A drop of sediment is placed on a glass slide, covered with a cover-slip and examined under a light microscope using 10x and 40x objectives.
  - > Low magnification – examine entire cover-slip using 10x objective to check for casts, large crystals and debris
  - > High magnification – using 40x dry objective, semi-quantitate leukocytes, erythrocytes, epithelial cells, crystals, bacteria, debris, sperm and fat droplets

## Lab tips:

- The dipstick package insert also contains useful information about test limitations and interfering substances.
- Do not use dipsticks for measuring specific gravity, leukocytes or nitrites as these are not reliable in animals.

# Urine crystals

The type of crystal present depends on urine pH, concentration of crystallogenic materials, urine temperature, and length of time between urine collection and examination.

Below is a table of common crystals that can be seen in urine, along with the pH of the urine in which these crystals usually precipitate and some additional information about the crystals. Note, that this is not a complete list and the pictures are not necessarily to scale (e.g. bilirubin crystals are usually quite small). Please send your urine samples to your local Awanui laboratory for testing and/or confirmation.

## Common urinary crystals:

Crystal	pH	Information
Ammonium biurate	Usually neutral to acidic pH $\leq 7$	Brown, spherical to irregular crystals ("thorn" apple). Common in Dalmatians, English bulldogs. In other breeds of dogs or cats, suggests liver dysfunction and portosystemic shunting.
Amorphous crystals	Phosphates pH $\geq 7$ Urates pH $\leq 7$	Small, irregularly shaped crystals. Can be of different composition (urates, xanthine, phosphate) depending on pH. Can be seen in healthy animals. Mimic bacterial cocci - perform a gram stain to differentiate.
Bilirubin	Acidic pH $\leq 7$	Small needle-like to granular yellow or yellow-brown crystals. Indicates bilirubinuria due to conjugated (direct) bilirubin. Bilirubinuria can be normal in dogs but is abnormal in other species (and can be seen prior to bilirubinaemia).
Calcium carbonate	Usually alkaline pH $\geq 7$	Spherical to irregular (rhomboid, dumb-bell, ovoid) yellow to colourless crystals. Spherical forms have radial striations. Normal in horses, guinea pigs. Not normally seen in dogs, cats or ruminants.
Calcium oxalate dihydrate	Usually neutral to acidic pH $\leq 7$	Colourless octahedrons, "envelopes". Can be seen in healthy animals or in animals with calcium oxalate uroliths, but also with hypercalciuria or hyperoxaluria (e.g. ethylene glycol – may see monohydrates, or oxalate rich plant ingestion). Develop over time with storage of urine.
Magnesium ammonium Phosphate (struvite)	Usually neutral to alkaline: pH $\geq 7$	Can be seen in healthy dogs, cats and ruminants. Also common in bacterial-induced alkaluria and with sterile struvite or mixed uroliths.

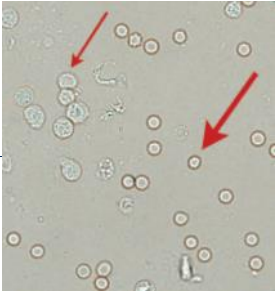

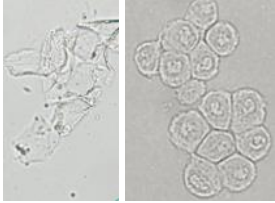
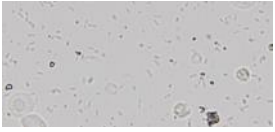

## Uncommon urine crystals:

Crystals less commonly encountered include uric acid, calcium carbonate monohydrate (ethylene glycol toxicity), calcium phosphate, cysteine (flat hexagonal), drug-associated crystals, tyrosine and cholesterol.

# Urine cells

Urine is a hostile environment for cells since they encounter abnormal osmotic pressures, pH changes, and exposure to toxic metabolites. If a delay in urine examination is unavoidable, refrigeration will slow degeneration of cells. For routine purposes, cells are examined as unstained wet-mounts of urine sediment. Red blood cells and leukocytes are quantified as cells/ HPF (high power field - 40x); other cell types are usually subjectively noted as "small, moderate or large numbers".

## Urinary cells:

Cell Type	Information
Leukocytes (WBC)	 <p>White blood cells (thin arrow) appear as round, colourless cells with a grainy texture. Up to 5 WBC/ HPF generally are considered acceptable for "normal" urine. Urine with a large number of leukocytes should be cultured, even if bacteria are not evident in the slide.</p>
Erythrocytes (RBC)	 <p>Red blood cells (thick arrow) appear as round, slightly red-tinged, smooth textured cells, which may be biconcave in fresh urine. May be spiky (crenated) in stored urine and may lyse in very alkaline or dilute urine. Normal urine can contain up to 5 RBC/ HPF.</p>
Epithelial cells	 <p>Squamous (L): flat cells derived from the urethra, vagina, vulva or prepuce. Most commonly represent contamination in voided urine.</p> <p>Transitional ®: round or pear-shaped cells derived from the bladder, ureters, pelvis or urethra. Can be seen in normal urine as single cells or small clusters, more may exfoliate with inflammation. Difficult to distinguish from neoplastic cells - this requires urine cytology.</p>
Bacteria	 <p>The presence of large numbers of bacteria and WBCs (in clean samples) usually indicates an infection and inflammation of the urinary tract. Bacteria can be difficult to visualise in wet preps (especially cocci). Gram stain is always recommended to confirm.</p>
Casts	 <p>Casts are made primarily of mucoprotein secreted by some renal epithelial cells. <b>Hyaline</b> (L) casts form in the absence of cells and are clear, colourless, cylindrical structures. <b>Cellular</b> casts have distinct cells within the protein matrix. <b>Granular</b> ® casts form as cellular material within casts breaks down and becomes coarsely then finely granulated. <b>Waxy</b> casts are the final stage of cast degeneration and have a smooth appearance with no internal texture.</p> <p>Hyaline and finely granular casts may be seen in urine from healthy animals. Cellular, coarsely granular and waxy casts always indicate renal pathology.</p>

## Lab tips:

- Urinalysis and culture preservative tubes are available via our consumables order form. These can be used to preserve the urine if the sample cannot be sent to the laboratory same day for testing.
- The absence of increased WBC (and bacteria) does NOT rule out infection - culture is always recommended.

This information sheet is intended as a guideline only - microscopy should always be carried out by trained and experienced personnel.