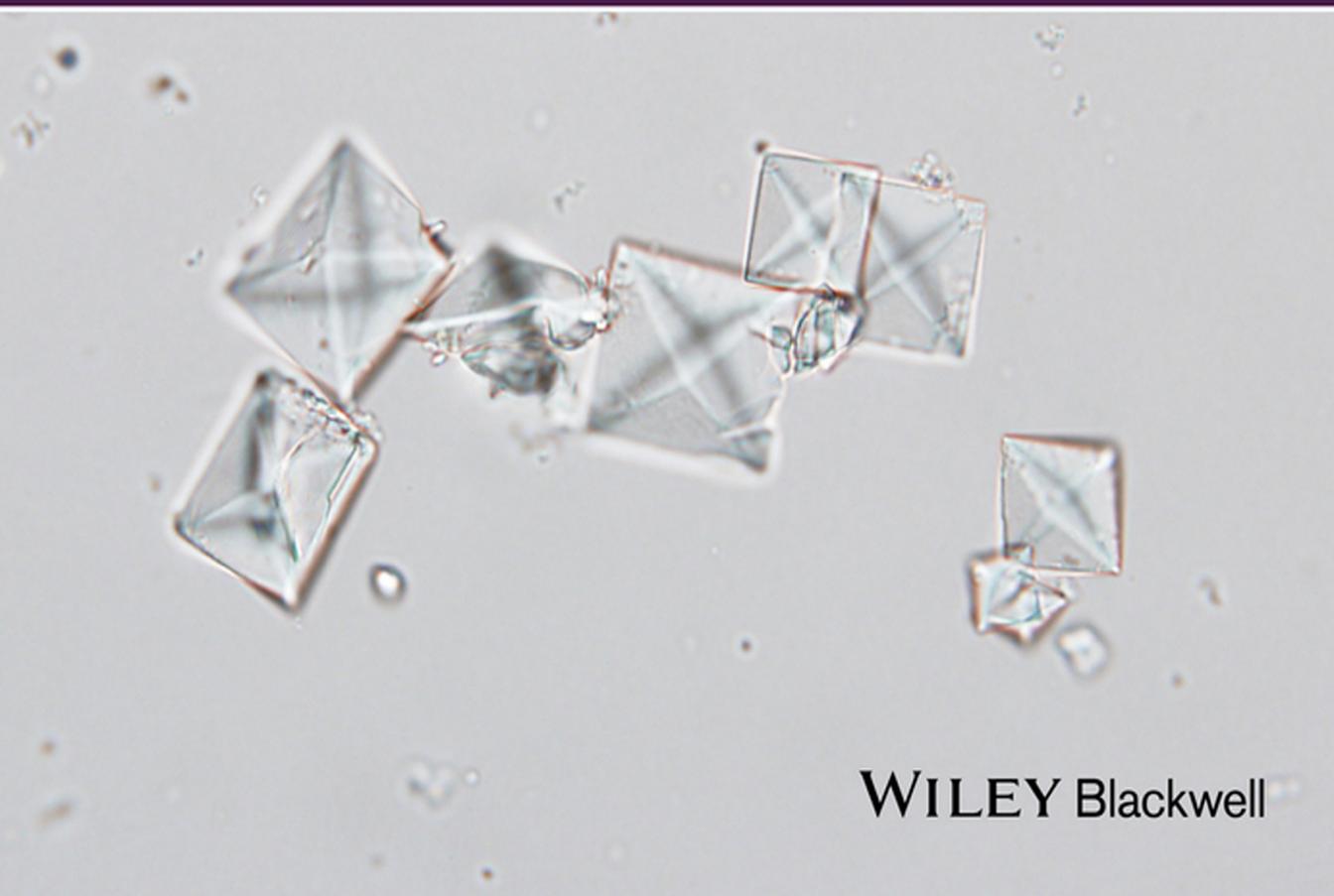


# Atlas of Canine and Feline Urinalysis

**Theresa E. Rizzi, Amy Valenciano, Mary Bowles, Rick Cowell,  
Ronald Tyler, and Dennis B. DeNicola**



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## Dedication

The authors would like to dedicate this Atlas to our families who supported us not only in our efforts to write the text but also in the many years spent in acquiring the knowledge to develop its content. We also dedicate this Atlas to the veterinary practitioners, technicians, diagnostic laboratory personnel, and students who strive to enhance the care of the dogs and cats that enrich people's lives.

## Personal Dedications

My efforts are dedicated to Jesus Christ, Lord and Savior, and to my husband, Daniel, daughter, Avery, and son, Ty.

Amy Valenciano

To my mother who gave me my core tenants of faith, honesty and respect; my amazing wife, Reba, for her patience and support; my children – Reba, Ron, Britt, and Blake – who have made my life truly wonderful, exciting, and worthwhile; and the many exceptional colleagues who have taught, inspired and guided me – especially Roger Panciera for his mentorship and Rick Cowell for his many contributions to my development as a person and pathologist and, most of all, for his friendship through the years.

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## Introduction

Urinalysis (UA) is a relatively rapid diagnostic test that provides information about the urinary system as well as other body systems, and is often performed as part of the minimum database of diagnostic tests that includes a complete blood count (CBC) and clinical biochemistry profile. Indications for performing a UA include clinical signs associated with the urinary tract, but also as part of a general health screen, in patients with systemic illness, when monitoring a response to treatment, and in screening for breed-related urinary tract disease.

There are four components to a complete UA: evaluation of the urine sample's physical

characteristics, the measurement of specific gravity, assessment of chemical properties, and the microscopic examination of urine sediment. The UA, when performed in-house, should be evaluated soon after collection to eliminate artifacts that occur due to a time delay, thus emphasizing the importance of an accurate evaluation of the complete UA.

The purpose of the *Atlas of Canine and Feline Urinalysis* is to aid veterinary practitioners, veterinary technicians, veterinary students, and veterinary diagnostic laboratory personnel in the accurate collection, handling, and evaluation of canine and feline urine samples.



## 1

## Sample Collection and Handling

The method of urine collection and the subsequent handling of the sample can influence the interpretation of results. The following discussion is a review of urine collection and handling techniques.

### Collection of Urine Samples

The three techniques for urine collection are: free-catch, catheterization, and cystocentesis. Each of these methods of collection and their associated advantages and disadvantages will be discussed. General considerations related to urine sample collection, handling, and submission, regardless of collection method, are listed in Box 1.1 (Figures 1.1–1.4).

#### Free-Catch Urine Collection

The free-catch method of urine collection (Box 1.2 and Figures 1.5–1.9) is often easy to perform but is dependent upon the cooperation of the patient and may be difficult to accomplish in patients with conditions producing urge incontinence. Samples are usually collected during normal voiding or by manual external compression of the urinary bladder. Normal voiding free-catch urine sampling can often be performed by the owners and does not pose a risk to the pet. The manual compression of a distended urinary bladder (Box 1.3 and Figures 1.10–1.14) may be at the convenience of the collector; however, drawbacks include

sample contamination, urinary bladder trauma, and reflux of infected urine into the ureters, kidney, and prostate. Furthermore, this technique cannot be used following a cystotomy operation and may be unpleasant in other postoperative laparotomy patients.

Collecting a midstream urine sample is preferred to minimize sample contamination; however, some contamination with cells, bacteria, and debris from the distal urethra, genital tract, and external skin and hair coat is unavoidable. Obtaining an optimal free-catch sample can be facilitated by using one container to collect the beginning of the urine stream and then changing to a second collecting container as the urine stream continues. The urine in the second container should be more representative of a true midstream sample. In some cases, a free-catch sample containing white cells, bacteria, and/or protein may be an indication to collect a subsequent patient urine sample via cystocentesis or catheterization in order to help establish the source of the abnormalities identified in the voided sample.

Sometimes a satisfactory free-catch sample cannot be obtained either during normal voiding or via manual expression, most commonly due to the pet's behavior or urge incontinence. Manual expression can be especially problematic in male cats as a result of resistance to handling and difficulty in initiating voiding due to the small diameter of the male feline urethra. Collecting urine by catheterization or cystocentesis are alternative options but not readily accomplished

**Box 1.1 General considerations for urine sample collection, handling, and submission.****Collection**

1. Observe principles of aseptic technique as much as possible
2. Collect adequate volume (minimum of 5 mL recommended) (Figure 1.1)
3. Clean and/or sterile container provided by veterinarian preferred for collection for UA
4. Sterile container preferred for collection of sample to be cultured
5. When possible, withhold drugs and fluid administration prior to sample collection

**Handling**

1. Ideally UA should be performed within 60 minutes of sample collection and no longer than 6 hours following collection
2. Refrigerate and cap the sample when UA cannot be performed within 60 minutes of collection (if possible, perform the dipstick portion prior to refrigeration)
3. Refrigerated samples should be brought to room temperature prior to performing UA

**Submission**

1. Container submitted should identify sample as urine, be capped, and have adequate patient identification (Figure 1.2)
2. Consider using preservative tube\* for storage and submission of sample for culture
3. Sample for cytologic evaluation should include one or more air-dried slides of urine sediment prepared by the blood smear or squash preparation technique along with a urine sample placed in an EDTA tube (Figure 1.3)
4. Pertinent information should be provided for samples submitted for evaluation to an outside laboratory, including patient signalment, history, and method of urine collection
5. Fasted samples submitted for evaluation frequently have increased specific gravity values, more cells and casts, and decreased pH values compared to non-fasted samples

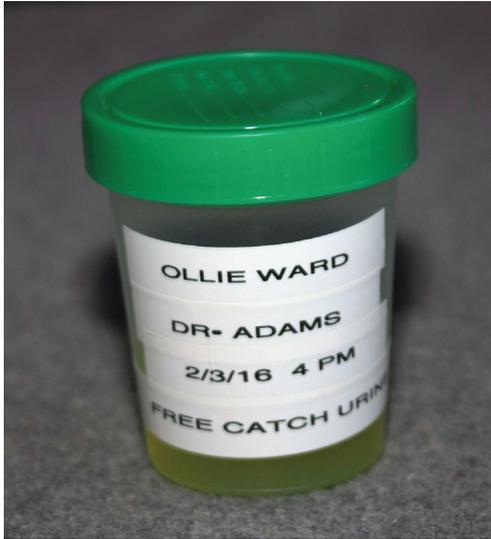
UA=urinalysis

\*e.g. BD Vacutainer® Culture and Sensitivity Preservative Tube. The BD 4-mL urine culture preservative tube kit includes a urine transfer straw which can be used to facilitate aspiration of urine into the tube (Figure 1.4). Use of the transfer straw is optional. Although the manufacturer recommends adding a minimum of 3 mL of patient urine for an optimum preservative to urine ratio, obtaining that amount for urine from canine and feline patients can be challenging. It has been the authors' experience that the BD 4-mL urine culture preservative tube can be employed successfully for culture using a much smaller volume ( $\geq 0.5$  mL) of urine, when necessary.



**Figure 1.1** The minimum recommended volume for routine urinalysis is 5 mL or 1 teaspoon.

in all patients. Consequently, analysis of post-voided urine collected from a variety of surfaces may be necessary in select cases (Box 1.4 and Figure 1.15). Voided cat urine can sometimes be collected from a clean litter pan to which nonabsorbable plastic beads (e.g. Uri-Void™) or hydrophobic sand (Kit4Cat™) has been added. Cat owners may also use clean glass aquarium beads, straws which have been cut up, or plastic craft beads as litter substitutes. In some cases urine can



**Figure 1.2** Urine submitted for analysis should be submitted in a suitable, capped container with appropriate labeling.

be successfully collected from a litter pan after a feline patient has voided on top of clinging plastic wrap that has been placed over the cat's usual litter or, in the case of outdoor cats, over a layer of dirt (Figure 1.16). At times the only available urine for analysis is a sample that has been voided onto a floor, tabletop, or other contaminated surface. This



**Figure 1.3** Cytologic evaluation of urine can be enhanced by including a urine sample submitted in an EDTA tube.

contamination factor must be taken into consideration when evaluating such a sample. Prompt examination of the collected urine sample should decrease the level of artifacts encountered. As would be expected, the less contaminated the collection surface, the more reliable the urinalysis results obtained. However, disinfectants used in cleaning the surface from which a urine sample is subsequently obtained also have the potential to alter the urinalysis results, particularly when performing dipstick colorimetric tests. Post-voided urine samples obtained from a surface are generally unsatisfactory for accurate identification of infectious agents, especially if there is a time delay in analysis. At minimum, specific gravity of the urine specimen can usually be determined with reasonable accuracy.



(a)



(b)

**Figure 1.4** (a) BD Vacutainer® 4-mL urine culture preservative tube kit. (b) Culture preservative tube attached to urine transfer straw.

**Box 1.2 Techniques for obtaining free catch urine samples – normal voiding.****Canine Technique**

1. If the dog's hair coat around the vulva or prepuce is notably dirty, clean the area and pat dry
2. Walk the dog on a leash early in the morning, after feeding, or at another time that the dog is accustomed to urinating
3. Observe the dog for initiation of micturition and be prepared to collect a sample at the beginning of urination. If desired, latex gloves can be worn by the collector for his/her protection. The collector can plan on positioning the urine container with his/her hands or with a device designed to hold and position the container. Commercial collection devices are available (e.g. Olympic Clean-Catch™) or can be made at home. One such homemade device consists of a yardstick or pole/broom-type handle taped to the handle of a ladle or suitable plastic measuring cup (Figure 1.5). Have one or two suitable containers available for urine collection. The container(s) should be clean and dry and appropriate for the size of the dog. Container(s) may be provided by the veterinarian or a suitable clean, dry household plastic or glass container may be used for urine collection. Smaller dogs may require a flatter collecting receptacle such as a shallow plastic tray, a Styrofoam plate with a raised rim, or a metal, disposable pie plate (Figure 1.6)
4. As soon as micturition is initiated or a micturition posture is assumed, place the collection container as unobtrusively as possible under the vulva, immediately anterior and ventral to the prepuce, or directly in the urine stream produced. If possible, obtain at least 5–10 mL (1–2 tsp) for urinalysis. If the collector is able, a second container (midstream sample) should be positioned for urine collection provided the dog is continuing to urinate after a sample of the initial urine stream has been obtained in the first container (Figure 1.7)
5. The collector should thoroughly wash his/her hands following the collection process
6. After an appropriate urine sample has been obtained, the specimen may need to be transferred to a different, more secure container for transport, depending upon the receptacle used for collection. A lid or plastic wrap cover should be placed over the transport container holding the specimen. In the case where two urine samples have been obtained, an initial stream sample (first container) and a midstream sample (second container), the midstream specimen is the preferred sample for submission. If the urine cannot be taken to a veterinarian or examined within 60 minutes, the sample should be refrigerated unless the collector has been instructed otherwise by the veterinarian. If the specimen was not obtained at the veterinarian's office, the sample should be submitted to the veterinarian as soon as possible

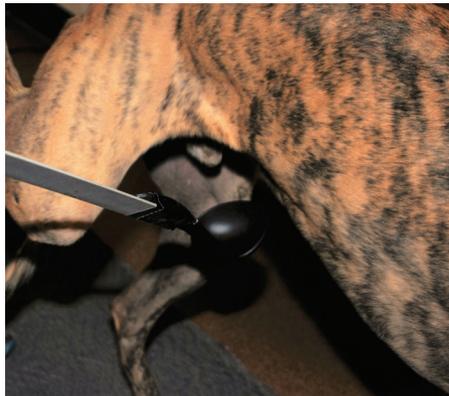
**Feline Technique**

1. The collector should gradually accustom the cat to being approached and having its hindquarters or tail touched while it is voiding or getting ready to void in the litter box
2. The collector should take note of times when the cat is most likely to urinate to improve his/her opportunity to obtain a urine sample. It is sometimes helpful to restrict the cat's access to the litter box overnight so that the cat will void shortly after regaining access to the box
3. Observe the cat for initiation of micturition in the litter box and have a suitable clean, dry container/device ready to collect urine. The collector may wish to wear latex gloves for his/her protection. The veterinarian may provide a container for urine collection. Usually cats require a flatter container for collection. Often the lid of a veterinarian-provided container will work better for obtaining a sample than the container itself (Figure 1.8). Household containers suitable for feline urine collection include clean, dry, small plastic or glass bowls, small rimmed plates, metal or plastic spoons, or shallow plastic trays – see Figure 1.6

4. As soon as micturition is initiated or a micturition posture is assumed, approach the rear end of the cat and place the collection container as unobtrusively as possible underneath the cat or directly in the urine stream if it can be seen. It may be necessary to gently lift the base of the tail to position the collection receptacle (Figure 1.9). If possible, obtain at least 5–10 mL (1–2 tsp) for urinalysis. Although a midstream sample (urine obtained after initiation of urination and while the cat is producing a steady stream) is preferred for submission, obtaining a true midstream specimen is often difficult to accomplish in the cat
5. The collector should thoroughly wash his/her hands following the collection process
6. After an appropriate urine sample has been obtained, the specimen may need to be transferred to a different, more secure container for transport, depending upon the receptacle used for collection. A lid or plastic wrap cover should be placed over any open transport container holding a specimen. If the urine cannot be taken to a veterinarian or examined within 60 minutes, the sample should be refrigerated unless the collector has been instructed otherwise by the veterinarian. If the specimen was not obtained at the veterinarian's office, the sample should be submitted to the veterinarian as soon as possible



(a)

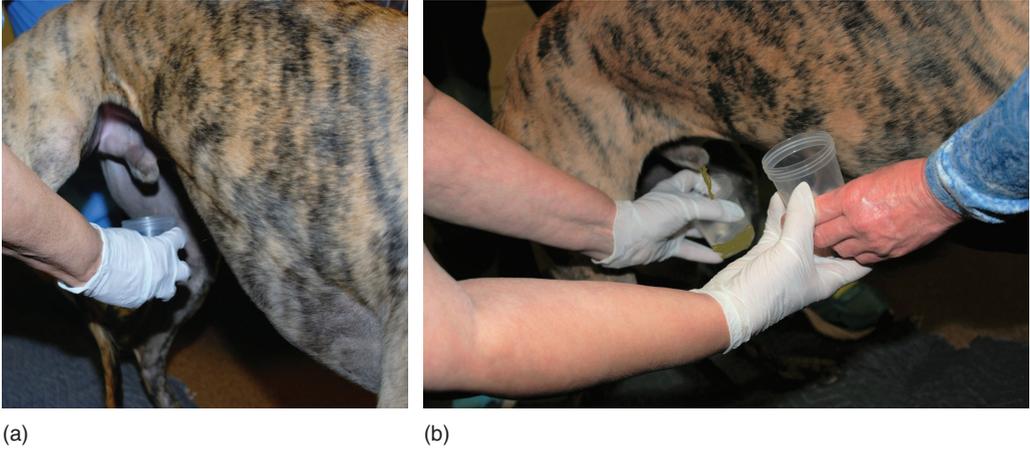


(b)

**Figure 1.5** (a) Homemade urine collection device consisting of a long-handled ladle attached to a yardstick with duct tape. (b) Homemade urine collection device appropriately positioned for collecting urine from a male dog by free-catch method.

**Figure 1.6** Common household containers which may be used for free-catch urine collection, depending upon the size of the dog or cat.





**Figure 1.7** (a) Appropriate positioning of standard veterinarian-issued urine collection container for a free-catch sample from a male dog. (b) Preparing to hand off a second urine collection container to obtain a mid-stream free-catch sample after an initial micturition sample of 5–10 mL has been obtained.



**Figure 1.8** Typical veterinarian-issued urine collection container with lid. For cats and small canine patients the container lid often works better for collecting a urine sample during micturition than the container itself.



**Figure 1.9** Positioning a large spoon or other receptacle posterior and ventral to the hindquarters for free-catch urine collection in the cat may require gently lifting the base of the tail.