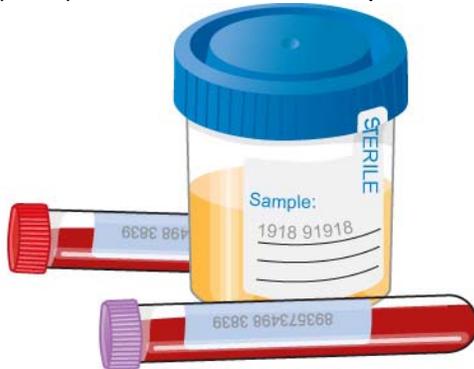


## Testing for Kidney Disease

### **What tests are required for the diagnosis of kidney disease?**

Generally the following screening tests are recommended: a *complete blood count (CBC)*, a *serum biochemical profile*, and a *urinalysis*.



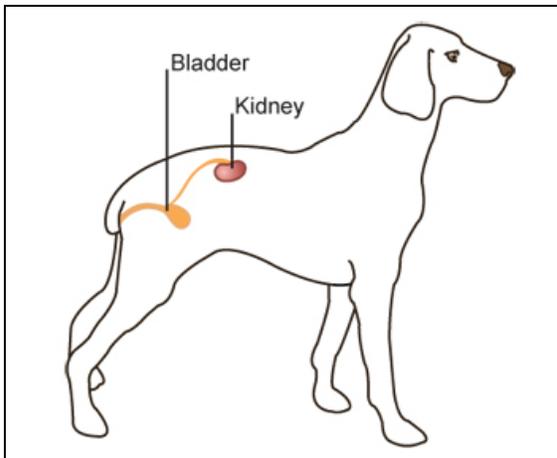
### **What might these tests indicate if my pet has kidney disease?**

The **complete blood count (CBC)** involves the evaluation of the red blood cells, the white blood cells and the platelet components of a single blood sample.

The kidneys produce a substance called erythropoietin that is necessary for proper red blood cell production within the bone marrow.

With kidney disease, the amount of erythropoietin produced may be decreased, thereby leading to a decrease in red blood cell production, which is reflected in the CBC as anemia.

The white blood cell numbers may be increased if the underlying cause of the kidney disease is infectious or inflammatory in nature.



Rarely, platelet numbers may be reduced if a clotting problem has occurred as a result of the underlying kidney disease.

The **serum biochemistry profile** requires a separate blood sample from which the serum (the liquid portion of blood) is separated from the cellular portion of blood. Serum contains many substances including enzymes, proteins, lipids (fats), glucose (sugar) and metabolic waste products.

Of most importance in the diagnosis of kidney disease are the determination of the levels of two substances, namely *blood urea nitrogen (BUN)* and *creatinine*.

*BUN* is a waste product of protein catabolism (breakdown) and *creatinine* is produced as a consequence of normal muscle metabolism. These two substances are normally

cleared from the bloodstream by the kidneys and therefore are indicators of how well the kidneys are functioning.

Increases in BUN and creatinine may be seen with kidney disease, as well as with dehydration and other causes of reduced blood flow to the kidneys.

*The magnitude of increase in BUN and creatinine reflect the degree of kidney disease but unfortunately any increase in the serum concentration of these parameters cannot be detected until approximately 75% of kidney function is already lost.*

The biochemistry profile will also measure other substances whose blood concentrations are normally regulated by the kidneys. These substances include *electrolytes* such as



A refractometer tests for the concentration of the urine.

sodium, potassium, chloride, bicarbonate, phosphorus, and calcium. It is important to document the concentrations of these substances because marked increases or decreases as a result of kidney disease can lead to other complications. For example, severe increases in potassium may cause cardiac arrhythmias.

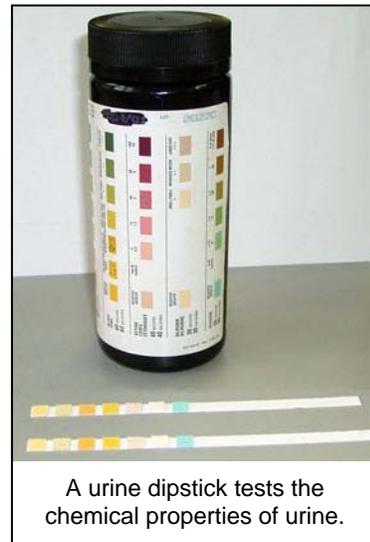
A complete urinalysis is essential for the proper interpretation of the urea and creatinine values in a serum biochemistry profile. A urinalysis may also provide important 'clues' with respect to the possible underlying cause of kidney disease.

In addition to its many other functions, the kidneys are responsible for regulation of body water by concentrating or diluting urine. Normally, the degree of urine concentration depends upon the amount of fluid consumed by your pet and its hydration status (consumption of a large amount of fluid will result in a dilute urine whereas consumption of a limited volume of fluid will result in very concentrated urine).

The degree of urine concentration is determined by measurement of the **specific gravity** of the urine using a special instrument called a *refractometer*. The specific gravity is important because with kidney disease, the kidneys lose their ability to effectively concentrate or dilute urine.

*The specific gravity is vital in determining the significance of any elevations in the serum BUN and creatinine.*

*In addition to kidney disease, dehydration or any other cause of decreased blood flow to the kidneys may result in an increase in serum BUN and creatinine. However, if the kidneys are healthy, they will respond to this dehydration or reduced blood flow by producing concentrated urine. If kidney disease exists however, the urine will not be concentrated, even in the face of elevated serum BUN and creatinine.*



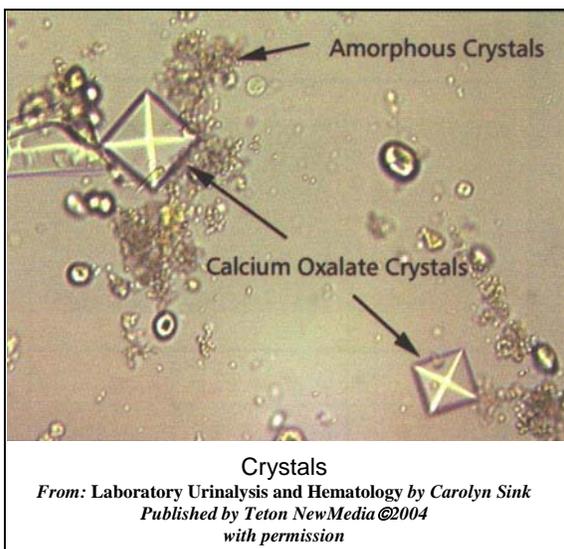
A urine dipstick tests the chemical properties of urine.

Other components of urine (such as the pH and the amount of protein or blood present in a sample) can be measured by using **urinary dipsticks**.

Urine dipsticks are simply small plastic strips that have special pads attached to them. These pads contain different chemicals that react with the different urinary components, allowing their measurement through color changes in the pads.

The presence of blood or increased protein in a urine sample might alert us to the possibility of urinary tract infection as a cause of kidney disease. Some kidney diseases are characterized by a large loss of protein in the urine. Such 'clues' derived from the dipstick measurements may help us to determine what factors are contributing to your pet's kidney disease.

The final component of the complete urinalysis is the **evaluation of the urine sediment**. This involves spinning a urine sample in a special instrument called a centrifuge so that any cellular elements within it are concentrated into a pellet. This concentrated pellet can then be transferred to a slide and examined under a microscope.



A number of features may provide 'clues' as to the underlying cause of kidney disease. These features include the presence of red blood cells, white blood cells, bacteria, crystalline material, and cellular casts.

Elevated numbers of red blood cells, white blood cells and bacteria indicate that an infection may be partially or wholly responsible for the kidney disease.

The presence of different types of crystals may suggest that urinary tract stones or perhaps even the ingestion of toxins (for example, ethylene glycol or antifreeze) has resulted in kidney disease.

The presence of cellular casts (casts are formed from damaged or destroyed cells that are molded into the shape of the damaged internal kidney structures) may indicate that there is recent damage to the kidney cells.

### ***So will these screening tests tell us exactly what the underlying cause of the kidney disease is?***

Occasionally, specific changes in these screening tests will point to an infectious, inflammatory or toxic cause to the kidney disease.

However, because the underlying causes of kidney disease are diverse, and because of the kidneys' innate ability to compensate, a reduction in kidney function characterized by either a decreased urinary concentrating ability or an increase in serum BUN and creatinine, is not measurable until 2/3rds to 3/4s of kidney function is already lost. By this time many kidney diseases have progressed to a chronic phase and the original cause can no longer be determined.

However, it is still important to evaluate your pet using these tests. Not only will they allow us to confirm that the cause of your pet's clinical symptoms is kidney disease but they will allow us to choose the most appropriate course of treatment and may indicate if further testing is required.

**What further testing might be required?**

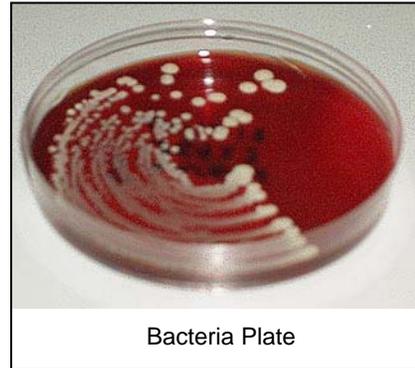
Depending upon your pet's clinical signs and the results of the initial screening tests further testing for kidney disease may include any of the following:

A **urinary protein/creatinine ratio** is generally done if the urine dipstick evaluation suggests that an excessive amount of protein is being lost in the urine. A urine sample is sent to a veterinary referral laboratory and the ratio of protein to creatinine in that sample is calculated. Normally very little protein is lost in the urine but the urine creatinine concentration will be high because the kidney normally filters this muscle metabolite from the bloodstream.

Different types of kidney disease will result in varying degrees of protein loss and therefore a variably increased protein/creatinine ratio.

**Urine culture** may be performed if the urinalysis findings are suggestive of a bacterial infection as the cause of the kidney disease.

**Leptospirosis titres** (please see the antibody titre handout for more information) may be requested if this organism is suspected of causing the kidney disease.



Occasionally **ultrasound examination** and/or kidney **biopsy** may be recommended to evaluate the kidneys.

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*This client information sheet is based on material written by Kristiina Ruotsalo, DVM, DVSc, Dip ACVP & Margo S. Tant BSc, DVM, DVSc.*

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