Clinical significance of biochemical detection in urine

The Importance of Urinalysis for Veterinary use

In addition to the external excretion of metabolic products, sick pet urine also contains other pathogens as well as physical particles and cellular components. The physical , biochemical and cellular analysis of pet urine allows a comprehensive pathological assessment for pet various diseases. Due to their special body structure, pets such as cats, dogs etc. are prone to suffer from diseases of the urinary tract, which can endanger the health of pets. Urinalysis testing allows a profound diagnosis of pet diseases such as:

- Kidney disease
- Liver diseases
- Diabetes mellitus
- Anemia
- Inflammation of urinary tract

In addition, periodic physical examination is an important measure to maintain the health of pets, and early regular urine examinations also provides a wide range of comprehensive health information for pets.

Ⅰ. Uric acid base reaction

Clinical significance: The clinical significance of urine acid-base changes. The change of urine pH will affect the type of crystal formation in urine is as follows:

1. Pathological acid urine is found in animals, such as carnivores, suckling animals, and starved animals. Pathological acid urine is found in fever, acidosis (diabetes, uremia, etc.). Oral acid salts, such as phosphate, ammonium chloride, and sodium chloride, can cause artificial acid urine.
2. Alkaline urine is present in herbivores. Pathologically alkaline urine is present in cystitis, urinary retention (bacterial breakdown of urea into ammonia), and alkalosis. Artificially alkaline urine can be produced by alkaline salts, such as sodium bicarbonate, sodium citrate, and sodium lactate.

Ⅱ.Urine protein

Clinical meaning: The protein content in the urine increases, the physiology and pathology should be considered when increased protein is seen.

1. Physiological increase, usually transient and mild, is caused by renal vasoconstriction and can be seen in animals with excessive muscle activity, excessive protein intake, female animals in estrus, pregnancy, emotional excitement and newborn animals (40 hours after birth).
2. Pathological increase can be divided into three conditions: increased proteinuria before kidney, increased proteinuria after kidney and increased proteinuria after kidney.

Ⅲ.Urine glucose

Clinical significance: There are two kinds of increased urine glucose, physiological and pathological.

1. Physiological increase occurs when the animal is highly excited and eats too much glucose or fructose, as well as large amounts of carbohydrate-rich food. Under these conditions, glucose may appear in the urine. After severe stress, cats may develop temporary hyperglycemia and diabetes.

2. Pathological increase is seen in hyperglycemia. When the blood sugar of an animal reaches 180 mg/DL (9.992 mmol/L) or higher (the threshold value for cattle is 100 mg/DL, i.e. 5.55 mmol/L), it exceeds the re-absorptive capacity of the renal tubules and causes glycosuria. Hyperglycemia can occur in diabetes mellitus, hyperadrenocorticism, glucagon sickness, hyper hypophysis, neonatal asphyxia, nervous disorders of cattle, hyperthyroidism, pancreatitis, enterotoxaemia of sheep, and transport tetany. Glycosuria with normal blood sugar levels is seen in primary tubular malabsorption. As for other types of nephropathy, glycosuria is rare. Intravenous administration of sugar-sweetened liquids may produce hyperglycemia and glycosuria.

Ⅳ.Urine ketone bodies

Acetone bodies include acetoacetic acid, β-hydroxybutyric acid and acetone. In normal animals, CO2 and water are formed after metabolism of fat in vivo. Therefore, in normal animals, ketone bodies are only 1.5-2 mg % in blood and almost not in urine. However, in the absence of carbohydrates, the catabolism

of sugar decreases and the production of oxaloacetic acid decreases. Not only acetyl-CoA cannot enter the tricarboxylic acid cycle, but it is condensed into acetoacetic acid, which increases the ketone bodies in vivo.

Clinical significance: Ketone bodies were found in the urine of cows during late pregnancy and peak lactation period, and also in ketosis, ewe toxemia of pregnancy, hypoglycemia of piglets, diabetes mellitus, any cause or disease causing animals not to eat, liver function injury, acidosis, excessive use of estrogen and feeding high-fat and low-sugar foods.

Normally, ketone is very low in the plasma, but when an animal is ketonic, ketone bodies are significantly present in the urine, and are in fact more concentrated in the urine than in the blood. Urine testing is therefore one of the easiest ways to detect ketosis.

Ⅴ.Urine Occult Blood and Hemoglobin

Clinical significance: The clinical significance of a positive laboratory test results of occult blood, hemoglobin, and myoglobin is as follows:

1. The urine after hematuria centrifuge does not see red dye, Urinary sediment microscopic examination has red blood cells, known as hematuria. Clinically seen in kidney disease (acute nephritis, nephropathy, renal abscess, renal tumor, renal infarction, kidney stones, pyelonephritis), urethritis, cystitis and stones, urethritis and trauma, prostatitis, parasitosis (kidney worm disease, canine dirofilariasis) and poisoning (copper, benzene and mercury poisoning).
2. Hemoglobinuria by blood vessels. Its clinical manifestations include postpartum hemoglobinuria, bacterial hemoglobinuria, babesiosis, neonatal hemolytic disease, blood transfusion incompatible with blood group, autoimmune hemolytic anemia, calf hunger and thirst after drinking a large amount of cold water, photosensitive allergy and some poisoning diseases (sulfonamide, copper, mercury, fern, onion poisoning, etc.).
3. Myoglobinuria is produced by muscle cell lysis, with brown or black urine and no anemia symptoms, which can be seen in equine myoglobinuria, animal snake venom poisoning, young animal white muscle disease, etc.

Ⅵ.Urinary Bilirubin

Clinical significance: Positive urine bilirubin test result, can be divided into three kinds of pre-liver, liver and after the liver.

Liver before the clinical at in hemolytic diseases (piroplasmosis, autoimmune hemolytic anemia). Hepatic mainly in liver diseases (hepatitis, liver necrosis, cirrhosis, liver tumors), leptospirosis and copper, phosphorus and thallium poisoning. After the liver mainly in bile duct obstruction (stones, tumors, parasites). Liver disease, common hyperbilirubinemia prior to hyperbilirubinemia, hemolytic disease is generally no urinary bilirubin, only when the liver is damaged, bilirubinuria occurs.

Ⅶ.Urobilinogen

Clinical significance: Increased urobilinogen is seen in the early stages of liver disease (hepatitis, toxic hepatitis, cirrhosis), hemolytic disease, congestive heart failure, constipation, and biliary obstruction.

The reduction of urobilinogen can be seen in the late stage of intestinal obstruction, nephritis (polyuria), diarrhea, oral antibiotic drugs (inhibiting or killing intestinal bacteria), etc.

Ⅷ.Urine nitrite

At Dogs, cats and other animals, because the urine normally contains vitamin C, it can interfere this reaction. There is a very high false negative reaction, therefore, the use of urinary nitrite test to screen the urine of animals to check whether there are bacteria, is not applicable.

The clinical significance of pet urine formed elements

Pet urine formed elements mainly include cellular components, casts and crystals,

I. Epithelial Cells

Renal (small round) epithelial cells derived from the renal tubular epithelium. Renal epithelial cells increased in the urinary sediment, clinically seen in acute nephritis.

II. Red Blood Cells

Under high power field, the number of red blood cells in urinary sediment reaches 4-5/HPF, indicating that there is bleeding in the urinary tract, which may be inflammatory or traumatic.

III. White Blood Cells

Under high power field, the number of white blood cells in urinary sediment reaches 5-8/HPF, indicating inflammation of the urogenital tract. Leukocytosis in urine is often accompanied by bacteriuria, but bacteriuria is not necessarily accompanied by pyuria. Only when pyuria occurs, pus cells could be found in urine sediment.

IV. Casts

1. Transparent cast can appear in normal animal urine, but it is more common in the urine sediment when the animal is overworked, or kidney is moderately irritated.
2. Pathological casts are dissolved in alkaline urine. Distal convoluted tubule casts may be intermittently discharged into the urine. Sometimes casts may be seen in the urine sediment of the same sick animal, sometimes not. Therefore, even if no casts are found in the urine sediment, kidney disease cannot be ruled out. In severe chronic kidney disease, multiple casts can be detected. There are only a small number of casts in the normal urine of dogs and cats.

V. Crystals

1. Easy to form crystals in alkaline urine are: A) Struvite: may be normal or associated with the formation of urolith. B) Amorphous phosphate: may be normal or associated with the formation of urolith. C) Calcium phosphate and calcium carbonate: associated with urolithiasis.
2. Easy to form crystals in the acid urine are: A) Urate: urolithiasis or

associated with metabolic defects. B) Cystine: urolithiasis or associated with metabolic defects.

3. Calcium oxalate: typical type, which may be normal or associated with urolith production. Poisoning may also result from prolonged exposure to acidic foods or ethylene glycol.

4. Bilirubin crystals may be normal in dogs, especially in female dogs, but may also indicate liver disease or hemolysis. All bilirubin crystals in cats are abnormal.

5. Sulfadiazine crystals: it is seen in the application of excessive sulfadiazine drug treatment.