COOL SPRINGS
ANIMAL HOSPITAL

Chronic Renal Failure

Introduction:

Chronic kidney disease is defined as kidney disease that has been present for months to years. Chronic renal disease (CRD), chronic renal failure (CRF), and chronic renal insufficiency refer to the same condition. CKD is not a single disease. There are many different causes of CKD but by the time the animal shows signs of kidney disease the cause may no longer be apparent. Some potential causes of CRF include: congenital malformation of the kidneys (birth defects), chronic bacterial infection of the kidneys with or without kidney stones (pyelonephritis), high blood pressure (hypertension), or diseases associated with the immune system (e.g. glomerulonephritis, systemic lupus). However, often the cause of CKD is unknown.

Chronic kidney disease is sometimes diagnosed on routine bloodwork panels. It can also present when the patient suddenly begins showing clinical signs. By the time the pet shows signs of CKD, the damage is likely severe. Unfortunately, there is no cure for CKD. CKD is usually fatal in months to years, but various treatments can keep the pet comfortable and with a good quality of life for months to years.

Kidney Functions:

The microscopic unit of the kidney is called the nephron. Each kidney contains thousands of nephrons. When the pet is young and healthy not all nephrons are working all of the time; some nephrons are held in reserve. As the animal ages or if the kidneys are damaged, some nephrons die and other resting nephrons take over the work of those that die. Eventually all the remaining nephrons are working. When there are no extra nephrons remaining and kidney damage continues the pet will start showing signs of CKD. Because of this stepwise loss of nephrons the kidneys are able to "hide" the fact that they are damaged until the damage is severe. When 2/3 of the nephrons have been lost the pet is no longer able to conserve water and the pet passes larger amounts of dilute urine. By the time a pet has an elevation in the waste product creatinine in its blood, 75% of the nephrons in both kidneys have been lost.

When blood flows through the kidneys, the kidneys act as a complex filter that removes from blood wastes that are generated from break down of food, old cells, toxins or poisons and many drugs that are given for treatment of other diseases. The wastes are removed with water as urine. Waste products than can be measured in the blood include creatinine and urea nitrogen but there are many other waste products that are not measured by blood tests. The kidney also acts as a filter to keep "good" substances in the blood. The kidneys regulate the amount of water in the blood by excreting extra water and retaining water to prevent dehydration by varying the amount of urine that is produced. The kidneys help regulate blood pressure by saving or eliminating sodium based on how much sodium the pet is eating. The kidneys help regulate calcium and vitamin D which keep bones strong. The kidneys produce a substance that helps with the creation of new red blood cells. Because the kidneys have so many functions, when the kidneys are not working normally, there are many signs that the pet may show.

Clinical Signs:

Because the kidneys perform so many functions, the signs pets with CKD show can vary quite a bit. The signs may be severe or may be subtle and slowly progressive. Despite the chronic nature of the disease, sometimes signs appear suddenly. Some of the more common signs of CKD include: drinking too much (polydipsia) and urinating large volumes of urine (polyuria), vomiting and/or diarrhea, lack of appetite and weight loss, general depression and lethargy, and sometimes anemia resulting in pale gums and weakness. The signs seen in pets with CKD are not specific for CKD and may be seen with many other diseases so blood and urine tests are needed to make a diagnosis of CKD.

Diagnosis:

Abnormalities that are often seen on diagnostic blood and urine tests include: anemia without signs of a response by the body to the low blood count (non regenerative anemia), increased wastes that are normally removed by the kidneys (blood urea nitrogen [BUN] and creatinine), increased phosphorus, calcium is often normal but can be elevated in some pets with CKD and rarely is decreased, and dilute urine.

A diagnosis of CKD can usually be made based on the signs, physical examination and blood and urine tests but other tests may be performed to look for an underlying cause for the CKD and/or to "stage" the CKD.

Once CKD is diagnosed, other diagnostic tests may be done to evaluate the extent and possibly find a cause for the kidney failure. These tests include: abdominal ultrasound to determine the kidney size, blood pressure measurement to determine if the patient has hypertension in conjunction with the kidney disease, bacterial culture to rule out infectious causes of CKD, or a kidney biopsy to look for a definitive cause of the CKD.

Treatment:

The severity of the pet's signs will determine what treatments are needed. Not all treatments presented below may be needed or appropriate for each pet with a diagnosis of CKD. Treatments may also be started incrementally.

Pets with severe signs may be hospitalized for fluid and intravenous drug treatment to reduce the amount of waste products in their body. Many pets with CKD will feel better in response to treatment with IV fluids, but if the kidney disease is extremely severe the pet may not respond to treatment.

Those pets who are still eating and not showing severe signs are treated with a variety of treatments, often introducing treatments incrementally as new signs develop. The treatment approach is often called "conservative" compared to more aggressive treatments such as hospitalization for fluid therapy, dialysis or kidney transplantation. Treatments are designed to reduce the work the kidneys need to perform, to replace substances that may be too low and to reduce wastes that accumulate such as urea and phosphorus. The initial response to conservative therapy may be relatively slow, taking weeks to months to see a response.

The following is a list of treatment options for patients with chronic kidney disease. The first three treatments listed, diet water and SQ fluids, are the most common treatments initiated with patients who have CKD. Not all of these treatments are typically needed for every patient with CKD and a treatment plan is tailored on a patient by patient basis.

1. **Diet:** Feeding of a kidney diet is usually recommended. Kidney diets contain less protein compared to other diets and the protein is high in quality. It is protein in the diet that is converted to waste products that the kidneys must remove in the urine. The higher the quality of the protein in the diet, the less

wastes created for the kidneys to eliminate. Low quality protein requires the kidneys remove more wastes, which makes them work harder. Egg and meat contain higher quality protein; cereal grain protein is of lower quality which leads to more wastes for the kidneys to eliminate. Protein is used by the body to repair cells and tissues that are continually regenerating, so a pet needs some protein in their diet. By feeding a low quantity, but high quality protein diet that contains an appropriate amount of fats and carbohydrates, the pet's body can use the protein for replacing the cells and tissues and use the fat and carbohydrates for energy. Kidney diets also contain a lower amount of phosphorus. Phosphorus accumulates in the blood when the kidneys are diseased. Kidney diets control the amount of other substances that may be too high or too low in patients with CKD such as salt, potassium, magnesium and B vitamins. There are differences in the kidney diets for dogs and cats. When making diet changes it is often beneficial to gradually introduce the new diet by adding increasing amounts of the new diet while reducing the amount of the current diet over 1 to 2 weeks. The pet is more likely to accept a new diet when it is introduced gradually and it is less stressful to the kidneys to gradually adapt to changes in the diet.

2. **Water:** Because pets with kidney disease cannot conserve water by making concentrated urine, their water intake is very important to prevent dehydration. Make sure they always have plenty of fresh water available. If the pet is not eating well, or is vomiting, then he) may not be drinking enough and may get dehydrated. Pets can be encouraged to drink by giving them flavored broths in addition to plain water. The broth should be low in sodium and its best to discuss with your veterinarian other ingredients in the broth to make sure it doesn't contain substances that will make the kidneys work harder.
3. **Subcutaneous Fluids:** Some cats and dogs with kidney disease may not drink enough to prevent becoming dehydrated and may benefit from the administration of intermittent SC fluids that are easily given at home.
4. **Potassium:** Lack of appetite and increased loss of potassium in urine may result in low body potassium (hypokalemia). Cats with CKD are more likely to have low body potassium than are dogs. Cats with low potassium may develop painful muscles. Both cats and dogs may be weak when potassium is low. Cat kidney diets contain higher levels of potassium so additional supplementation is probably not needed unless the cat shows signs of muscle pain. Potassium gluconate or citrate can be given by mouth if potassium supplementation is needed. Potassium chloride is acidifying and is not recommended.
5. **Sodium:** Diseased kidneys are less efficient at regulating sodium and sodium in turn helps control blood volume and pressure. Excess sodium can lead to water retention and not enough sodium can lead to dehydration. When changing diets that contain different amounts of sodium (kidney diets usually have less sodium than regular diets) make the change gradually over several weeks. Use caution when giving your pet table scraps or treats that may be high in sodium.
6. **High blood pressure (hypertension):** Many pets with CKD have high blood pressure. High blood pressure can contribute to further decline of kidney function and can occasionally lead to sudden blindness from retinal detachment. Ideally blood pressure should be measured by your veterinarian and hypertension confirmed before giving drugs to treat high blood pressure but measuring true blood pressure in dogs and cats can be difficult. If the pet has an elevation in blood pressure it may be due to the excitement of being examined or due to CKD. The calmer you are able to keep your pet during examination, the more reliable the readings for blood pressure. There are several drugs that may be used to manage high blood pressure including enalapril, benazepril, or amlodipine (and others). Enalapril and benazepril are in a class of drugs called ACE inhibitors and are sometimes used in pets with CKD that have abnormal amounts of protein in their urine even when blood pressure is normal.
7. **Anemia:** The kidneys play a role in producing a hormone called erythropoietin which stimulates the production of new red blood cells. Red blood cells live about a hundred days so new cells are continually being made. Less erythropoietin is made in pets with CKD leading to anemia. The packed cell volume (PVC) (also called hematocrit) is the percentage of blood cells compared to fluid in whole blood. When the PCV is ~20 in cats and ~ 25% in dogs, anemia may contribute to lack of activity and weakness.

8. **Avoiding stress:** You are in the best position to judge what is stressful to your pet. When a pet is stressed they may drink and eat less than normal. Reduced water intake is detrimental to diseased kidneys. When possible, keep your pet calm. That might mean for example: having an in-home pet sitter if your pet is stressed by boarding, removing the pet from the household during a party or limiting contact with other animals if these situations appear to be a source of stress for your pet. Extremes in heat or cold are stresses. Certain drugs such as prednisone/cortisone make the kidneys work harder.
9. **Kidney Transplantation:** There has been progress made in transplantation of kidneys, more for cats than for dogs.

Prognosis:

Prognosis for patients with chronic kidney disease is very variable. When patients show clinical signs, the disease is often more progressed and therefore the prognosis is worse. Some patients may survive for a few months, while some may live many years comfortably. This is something we can further discuss with you as we develop a treatment plan for your patient.