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The Ins and Outs of Managing Feline Chronic Kidney Disease

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Melanie obtained her veterinary technology degree from SUNY Ulster in 2008 and has been in specialty practices for the past 9 years, working in emergency/critical care and with boarded veterinary nutritionists. In 2011, she decided to obtain her veterinary technician specialist credential in nutrition; she felt that nutrition is often overlooked in general practice, critical care, and disease management. Melanie is an active member of the American Academy of Veterinary Nutrition and the committee of the Pet Nutrition Alliance. She lectures to owners as well as veterinary professionals on many topics.

Managing chronic kidney disease in cats can be a daunting task and is often frustrating for owners as well as practitioners and technicians. The goal in managing chronic renal disease is not to reverse the disease but to help maintain and/or improve the pet's quality of life, offer support for the owners, and slow progression of the disease through various treatment options.

WHAT DO THE KIDNEYS DO?

The kidneys play a major role in maintaining homeostasis within the body. Their primary responsibilities are to excrete water-soluble waste through the urine, help with endocrine function (by producing erythropoietin, angiotensin II, and calcitriol), maintain electrolyte balance, and filter toxins out of the blood. Nephrons (the functional units of the kidney) are made up of many parts, each playing a vital role in maintaining homeostasis (TABLE 1). Compared with other species, cats have a high proportion of nephrons with longer loops of Henle, allowing their urine specific gravity to exceed 1.080 in some cases.[1] Thus, dilute urine in a cat can be of concern, and further diagnostic testing may be needed to determine the cause.

Some patients with early kidney disease may present for a regular examination with no clinical signs, and an elevated creatinine level may be an incidental finding. Others may present with intermittent or acute vomiting, polyuria and/or polydipsia, lethargy, dehydration, weight loss, decreased appetite, or anorexia. Patients may need further workup to determine the cause of these clinical signs; if serum creatinine levels are elevated, further diagnostic and laboratory tests are indicated to rule out other causes and/or stage kidney disease.

STAGING KIDNEY DISEASE

Before kidney disease is treated, patients should be staged with the International Renal Interest Society (IRIS) staging system (TABLE 2). This system is based on laboratory tests and clinical signs. It is important to know the serum creatinine concentration in all diagnosed cats to develop a treatment plan, even before substaging can begin. However, creatinine levels can be influenced by many factors, including dehydration and cachexia. These values must be rechecked in dehydrated patients after they have become adequately hydrated to determine whether dehydration is a contributing factor. Factors for substaging include urine protein:creatinine ratios and arterial blood pressure measurements. A comprehensive guide on IRIS staging can be found at www.IRIS-kidney.com.

TABLE 1 Components of Nephrons

COMPONENT	FUNCTION
Proximal tubule	Reabsorbs glucose, amino acids, bicarbonate, filtered protein, and phosphate
Loop of Henle (ascending and descending limbs)	Enables urine to be concentrated; generates urea
Distal tubule	Controls sodium, potassium, calcium, and hydrogen ions
Collecting duct	Facilitates urea and water permeability and reabsorption of water

New testing/staging for renal disease includes symmetric dimethylarginine (SDMA) testing (available through IDEXX Laboratories). This test is an endogenous marker of glomerular filtration rate, and its results may aid in the treatment of chronic kidney disease in cats, helping healthcare providers recognize which patients are at risk before creatinine levels become elevated.

NUTRITIONAL MANAGEMENT OF FELINE KIDNEY DISEASE

The goals of nutritional management in feline kidney disease are to slow progression and control signs of uremia to achieve and/or maintain a better quality of life for patients. However, patients that are azotemic (have measurable amounts of urea in blood) and uremic (showing clinical signs associated with urea in blood) are often nauseous and at risk for becoming anorectic; thus, to prevent anorexia and hepatic lipidosis, it is preferable for these cats to eat some of the "wrong" diet than none of the "right" diet. To avoid the development of food aversion, prescription renal diets should not be introduced to hospitalized patients. These diets should only be fed to patients that feel well enough to eat them in a stress-free environment. Many factors go into making a feline prescription renal diet, and some nutrients are more important than others in terms of managing this disease. TABLE 3 outlines key nutritional recommendations for cats with chronic kidney disease.

TABLE 2 International Renal Interest Society Staging System for Chronic Kidney Disease in Cats

STAGE	FELINE SERUM CREATININE LEVELS (mg/dL)	COMMENTS
I	<1.6.	Nonazotemic; +/– abnormal renal palpation; trending increase in creatinine concentrations
II	1.6–2.8	Mild azotemia; clinical signs absent or mild
III	2.9–5.0	Moderate azotemia; clinical signs present
IV	>5.0	Severe azotemia; clinical signs present
Urine Protein:Creatinine Value		**Substage**
<0.2		Nonproteinuric (NP)
0.2–0.4		Borderline proteinuric (BP)
>0.4		Proteinuric (P)
Systolic Blood Pressure (mm Hg)		**Arterial Pressure (AP) Substage/Renal Damage**
<150		AP0 (minimal risk)
150–159		AP1 (low risk)
160–179		AP2 (moderate risk)
>180		AP3 (high risk)

International Renal Interest Society. IRIS Staging System for CKD. www.iris-kidney.com/pdf/n378.008-iris-website-staging-of-ckd-pdf.pdf. Accessed December 2, 2015.

TABLE 3
Key Nutritional Factors/Recommendations for Cats with Chronic Kidney Disease[3]

DIETARY COMPONENT	RECOMMENDATION
Water	Parenteral fluids if dehydrated; recommend canned/moist foods; free-choice water
Protein	28%–35% (dry-matter basis)
Phosphorus	0.3%–0.6% (dry-matter basis)
Sodium	<0.4% (dry-matter basis)
Potassium	0.7%–1.2% (dry-matter basis); if cat is hyperkalemic, switch to lower-potassium food

Water

Water intake is of utmost importance in all kidney patients. Polyuria can quickly lead to dehydration. Frequent vomiting and bouts of anorexia also contribute to dehydration in these patients much more quickly than in healthier cats. Feeding canned diets that are high in moisture (>75% as-fed basis), adding water to the existing canned or dry diet, and making sure all water bowls are cleaned daily may encourage water consumption. Circulating water fountains can be provided for cats that like to drink running or dripping water, and multiple water bowls should be offered throughout the home. Also, the size and depth of water bowls may need to be considered, and different types of water (e.g., distilled, warm, cold) may need to be tried. Canned diets are preferred because of their water content. When further diluting diets to increase water consumption, it must be taken into consideration that the calorie:volume ratio is also being diluted, and pets may need to consume a greater volume of food to maintain body weight.

Energy Requirements and Calories

Renal patients should be offered a variety of foods to see which they prefer, although preferences may differ from day to day and even meal to meal. Many flavors and consistencies of food are available, and getting patients to consume enough calories to prevent fat and muscle loss is imperative. Cats should consume sufficient calories to maintain their body weight and meet their daily energy requirement (BOX 1). Because fat contains more than 2.5 times more calories than protein and carbohydrates, higher-fat diets are often used in kidney patients; kidney diets are therefore more palatable and energy dense. Feeding several small meals daily helps patients reach their energy requirements and minimizes nausea associated with gastric distention and bilious vomiting syndrome.

Protein

Protein restriction is much discussed and extremely controversial in managing kidney disease in animals. Depending on the stage of renal disease, protein restriction may be warranted. It is not clear whether dietary protein levels are detrimental to managing kidney disease, but supplying enough high-quality protein to maintain muscle mass while moderately restricting protein intake helps decrease urine protein:creatinine ratios and improve signs of azotemia.[2,3]

Uremia and azotemia stem from degradation of endogenous protein, such as catabolism of muscle for energy, and excessive dietary protein. A high-quality, moderately protein-restricted diet is recommended in IRIS stages III and IV and whenever clinical signs of kidney disease are present. Feeding such a diet decreases nitrogenous waste while supplying adequate protein to help prevent muscle loss, hypoalbuminemia, anemia, and amino acid deficiency. Although providing a moderately protein-restricted diet will not slow the rate of disease progression, it has been shown to help with signs of uremia and to improve blood urea nitrogen levels,[2] which can help the pet feel better, thus, hopefully, leading to a better quality of life. Protein restriction should not be implemented unless renal patients have clinical signs of disease, such as nausea, vomiting, and lethargy. No studies have been published indicating that a high-protein diet is a primary cause of kidney disease, but moderate protein restriction has been shown to be beneficial in patients with existing renal disease and clinical signs.[2,3]

Phosphorus

Phosphate retention, caused by reduced glomerular filtration of phosphorus, is extremely common in kidney disease. Phosphate retention can lead to secondary hyperparathyroidism and hypocalcemia, as well as renal mineralization, further contributing to renal damage.[3] The increase in phosphate causes parathyroid hormone to be secreted, which in turn triggers the release of phosphate from bone. Release of parathyroid hormone in these patients is counterproductive and can lead to hypocalcemia. The first step in minimizing phosphorus

TECHPOINT

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retention is to decrease dietary phosphorus intake, to help slow the progression of kidney disease. Within 2 to 4 weeks of initiating a phosphorus-restricted diet, plasma phosphorus levels should be rechecked to make sure they are decreasing. If they remain unchanged or if the patient will not eat a reduced-phosphorus diet, intestinal phosphate binders may need to be prescribed by the veterinarian. Intestinal phosphate binders help patients excrete phosphorus through the gastrointestinal tract instead of through the kidneys, thus decreasing the workload on the nephrons.

Sodium

Sodium restriction is another controversial topic in the management of feline kidney disease. Previously, it was thought that excessive sodium intake could be detrimental to the kidneys and cause hypertension. Managing hypertension in feline patients is important because of the potential secondary effects of chronic hypertension, such as further kidney, eye, heart, and brain damage. There have been no studies showing that sodium restriction controls hypertension or slows disease progression in cats.[2] Currently, antihypertensive medications are considered the standard of care for cats with hypertension, rather than dietary sodium restriction. However, dietary sodium restriction may still be warranted to help reduce oxidative stress and sodium retention in feline kidney patients. Most prescription diets that are considered "renal friendly" contain low amounts of sodium and phosphorus and a moderate amount of high-quality protein.

Potassium

Hypokalemia can develop because of increased loss of potassium through the kidneys, inadequate dietary potassium intake, or acidifying diets.[2] Signs of hypokalemia include generalized muscle weakness and a stiff gait. Hypokalemia has been shown to decrease the effects of antidiuretic hormone, leading to polyuria. Impaired protein synthesis and weight loss are also significant side effects of hypokalemia. Supplementation should be considered in patients that have renal disease and a low serum potassium concentration. Potassium supplementation in the form of potassium gluconate or potassium citrate is often recommended, while potassium chloride should be avoided because of its acidifying properties.[2]

Hyperkalemia can result in anuria or oliguria in kidney patients and is considered a medical emergency. Hyperkalemia can cause cardiac arrhythmias, and patients must be placed on continuous electrocardiographic monitoring and treated with medications to facilitate excretion of potassium. In patients that are nonsymptomatic and nonoliguric, long-term treatment may be necessary.

OTHER FACTORS TO CONSIDER

B Vitamins

Because of anorexia, dehydration, and polyuria associated with chronic kidney disease, vitamin B supplementation may be warranted. B vitamins are water soluble, and kidney patients are likely to become deficient through water losses. Blood tests can be used to assess cobalamin (B_{12}) and folate (B_6) levels, but patients eating a complete and balanced commercial kidney diet may not need extra supplementation unless they have underlying gastrointestinal disease; some of these vitamins can be synthesized by the intestinal bacteria and are absorbed by parts of the small intestine. The easiest supplementation in patients that are dehydrated and/or anorectic is subcutaneous or intravenous administration of a vitamin B complex or subcutaneous administration of vitamin B_{12} on a strict schedule.

Omega-3 Fatty Acids

The use of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) along with antioxidants (vitamins E and C) has been shown to reduce renal oxidative damage in dogs, but no studies have been done in cats.[3] Adding fish oil with the correct EPA and DHA doses may be beneficial to feline kidney patients; however, administration must be initiated with caution, because diarrhea and decreased platelet adhesion

leading to anemia are potential side effects. Because of the potential complications, this therapy is recommended only in patients that are euhydrated and stable.

Acid–Base Balance

The kidneys play a significant role in the regulation of acid–base homeostasis. Cats that present with kidney disease are often acidotic because of their inability to excrete hydrogen ions and reabsorb bicarbonate. Metabolic acidosis can increase the catabolism of muscle and decrease the formation of bone mineral. Metabolic acidosis is also responsible for renal azotemia and can worsen hypokalemia as a result of potassium moving out of the cells and into the urine. Alkalinization therapy (e.g., sodium bicarbonate, potassium citrate, calcium carbonate) is often recommended in patients with chronic acidosis to prevent the effects of catabolism, nausea, and vomiting. Acidifying diets (such as diets formulated for struvite crystalluria) should be avoided. If multiple disease conditions exist concurrently, consultation with a veterinary nutritionist may be warranted to determine the best dietary option.

Constipation

Dehydration, decreased gastrointestinal motility, and side effects of medications often lead to constipation in cats with kidney disease. Ensuring hydration by providing enteral or parenteral fluids may help with chronic constipation issues; stool softeners, laxatives, and increasing moderately fermentable fiber intake may also be beneficial.

BOX 1 Calculating Daily Energy Requirement for Neutered Cats with Renal Insufficiency[3]

$$RER = 70(BW_{kg})^{0.75}$$

DER (kcal) range = 1.1 × RER to 1.4 × RER

For example, in a 4-kg cat:

$70(4\ kg)^{0.75}$ = 198 kcal/day = RER

RER × 1.1 = 218

RER × 1.4 = 277 kcal/day

DER range = 218–277 kcal/day

To calculate this, input the following on a calculator:

1. $BW_{kg} \times BW_{kg} \times BW_{kg}$ (4 x 4 x 4) = 64
2. √, √ (hit square root twice) = 2.82
3. × 70 = (multiply by 70, then equal sign to get the RER) = 198
4. × 1.1 = (multiply by 1.1, then equal sign to get the low end of the DER range) = 218
5. Clear
6. 198 × 1.4 = (to get the high end of the DER range) = 277

BW_{kg} = body weight in kilograms

DER = daily energy requirement

RER = resting energy requirement (amount of calories needed to perform essential body functions)

WHAT IF THEY WON'T EAT?

Transition to a new food should be gradual over 14 to 28 days, and diets should be started in a nonstressful environment. Coaxing techniques can be used to encourage pets to eat. As mentioned, the risk for food aversion can be reduced by not introducing renal diets while patients are hospitalized. Warming food and offering different textures (canned, dry, morsels, etc.) can help encourage pets to eat. Hand feeding and providing different feeding areas in the home can be beneficial. Wide, shallow bowls should be used to prevent the whiskers from touching the sides of the bowl. Also, elevated feeding bowls can provide relief in older cats with arthritis or hypokalemic patients with muscle weakness. Veterinarians may prescribe appetite stimulants (e.g., mirtazapine, cyproheptadine, catnip); side effects associated with these medications can differ among patients, so owners and doctors must weigh the benefits and risks. Antinausea medications can also be beneficial in azotemic patients that may have a decreased appetite due to gastric uremia, nausea, and/or vomiting.

Tuna juice, gravy, or low-sodium chicken broth (without onions or garlic) can be mixed with or placed on top of food to coax eating and increase water consumption. These items are sometimes high in sodium and are not complete and balanced, so they should be used only through the transition period, not long term.

For cats that are not eating enough to maintain body weight, feeding tubes may needed. Nasogastric tubes work well for hospitalized patients that are not stable enough to undergo anesthesia; however, the small diameter of the tube limits feeding choices to liquid-only diets. Esophagostomy tubes require anesthesia, but placement is a quick procedure and the tubes are easily maintained by owners at home. Recovery is minimal, and kidney-appropriate diets can be made into a slurry and fed through the esophagostomy tube; water can be administered to help provide hydration.

TECHPOINT

Chronic feline renal disease requires lifelong treatment and can be challenging for the veterinary staff, patients, and their families. Communication between veterinary staff and owners about treatment options helps ensure that affected pets have a good quality of life.

Some enteral medications may also be given through the tube to decrease stress to patients as well as owners.

Home-cooked meals, although neither convenient nor economical, may be used short term (or long term with added vitamin and mineral supplements). Any long-term homemade diet should be formulated under the direction of a boarded veterinary nutritionist. Cats that are stressed may prefer to eat in a quiet environment with less traffic or no other animals present. Food bowls should be kept away from litterboxes to avoid contamination. Food and water should be fresh and changed frequently. Feline pheromone collars and diffusers may also be helpful for anxious cats that are not feeling well, although these have not been researched extensively.

Discussing low-protein and low-phosphorus treats and table food options can increase owner compliance in keeping pets on a strict, kidney-friendly diet. Owners often show their love to their pets by offering treats. Encouraging owners to use dry renal-appropriate kibble or kidney-friendly "people food" as treats helps ensure compliance while giving owners options. Table foods that are lower in phosphorus and protein include white pasta, melon, white bread, honey, and rice cakes. It is important to check the nutritional label of human foods to determine if the food is appropriate for pets because ingredients and levels vary among brands. The nutritional content of many people foods can also be researched on the USDA National Nutrient Database (http://ndb.nal.usda.gov/). Before recommending table foods that are kidney appropriate, it is best to ensure that no concurrent medical conditions exist. Treats and table food should consist of no more than 10% of total caloric intake to ensure patients receive all their vitamins and minerals from their complete and balanced food. Educating owners about why phosphorus and moderate protein restriction is so important in kidney patients makes them more likely to comply.

SUPPORT FOR OWNERS

Telling owners that a pet has kidney disease can be met with much concern and confusion. Some people feel that such a diagnosis is an immediate death sentence, while others are overwhelmed and unsure of what to expect. Owners should be given a few days to think about the diagnosis and treatment options, but it is important to follow up. A phone call after diagnosis to offer advice and emotional support and to answer any questions helps ensure that pet owners are compliant with

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1. **The purpose of phosphorus restriction in feline renal disease is to**
   a. Reverse the signs of kidney damage
   b. Slow the progression of kidney disease
   c. Decrease nausea
   d. Increase appetite

2. **A cat with a serum creatinine of 3.1 mg/dL is considered to be in IRIS stage**
   a. I
   b. II
   c. III
   d. IV

3. **In addition to serum creatinine levels, which laboratory values can help stage renal disease?**
   a. Blood urea nitrogen and blood pressure
   b. Potassium and sodium
   c. Urine protein:creatinine ratio and blood urea nitrogen
   d. Blood pressure and urine protein:creatinine ratio

4. **Which of the following is an appropriate way to increase appetite in azotemic cats?**
   a. Offering high-protein foods
   b. Adding potassium citrate to their fluid regimen
   c. Administering appetite stimulants
   d. Offering renal-appropriate diets in the hospital

5. **Which of the following diets should not be fed to cats with renal disease because of its acidifying properties?**
   a. Prescription kidney diet
   b. Struvite crystalluria diet
   c. Restricted phosphorus diet
   d. Moderately restricted protein diet

6. **Which potassium supplement should be avoided in cats with chronic kidney disease because of its acidifying properties?**
   a. Potassium bromide
   b. Potassium citrate
   c. Potassium chloride
   d. Potassium gluconate

7. **What is the baseline daily energy requirement (DER) for a neutered 3-kg adult cat with kidney disease?**
   a. 170–220 kcal/day
   b. 240–290 kcal/day
   c. 100-150 kcal/day
   d. 340-380 kcal/day

8. **What is the purpose of protein restriction in a renal diet?**
   a. Slow the progression of renal disease
   b. Decrease the clinical signs associated with renal disease
   c. Decrease phosphorus reabsorption
   d. Avoid amino acid deficiency

9. **In cats with kidney disease, oliguria or anuria can be caused by**
   a. Hyperkalemia
   b. Hypokalemia
   c. Hepatic lipidosis
   d. Metabolic alkalosis

10. **One way to avoid constipation in feline renal patients is by**
    a. Using cobalamin therapy
    b. Administering antidiarrheal medications
    c. Feeding dry food
    d. Providing enteral and parenteral fluids

Glossary

Antidiuretic hormone: Hormone released by the pituitary that raises blood pressure, restricts blood vessels, and reduces excretion of urine

As-fed basis: Measurement of a specific nutrient in food, including moisture content

Dry-matter basis: Measurement of a specific nutrient in food minus the moisture content

Hepatic lipidosis: Liver disease occurring in malnourished and/or anorectic cats, in which the body converts fat into usable energy, causing fat to build up in the liver cells

Parathyroid hormone: Hormone released by parathyroid glands that regulates calcium and phosphorus levels in the blood

Serum creatinine: Measurement of the level of creatinine, a byproduct of muscle metabolism excreted by the kidneys, in the blood

Urine specific gravity: Test that measures the concentration of urine

recommendations given by the veterinary staff. Written educational materials provide owners with correct information, rather than potential misinformation from biased or uneducated sources on the Internet. Assuring owners that they are doing the best that they can and that the entire healthcare team is working together also increases compliance. Establishing a consistent routine for treatments and follow-up visits helps reduce stress for owners and patients alike.

Chronic feline renal disease requires lifelong treatment and can be challenging for the veterinary staff as well as the patients and their families. It is important to remember that nobody is prepared for this diagnosis, but communication between veterinary staff and owners about treatment options helps ensure that affected pets have a good quality of life. ■

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