Chronic Kidney Disease and Obesity – Canine

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Definition

Obesity is defined quantitatively as 15% to 20% above ideal body weight. Functionally, obesity impairs health and is sufficient to cause diseases. Specific distribution of fat in the body is known to be important as seen in "metabolic disease" in humans. ***Chronic kidney disease*** (CKD) is a more common disease in older dogs and a congenital form is seen occasionally in younger dogs. For more on obesity in dogs, see pages 32–33; for more on CKD in dogs, see pages 84–85.

Key Diagnostic Tools and Measures

Current body weight, body condition scoring (BCS) (see Appendix I), and a complete diet history should be obtained in evaluation of an obese cat with suspected CKD (see Appendix II). Serum or plasma concentrations of creatinine, urea nitrogen, phosphorus, calcium, electrolytes (sodium, potassium, chloride); urine protein-to-urine-creatinine ratio (UP:UC); urinalysis (sample collected by cystocentesis), and urine sediment analysis (urine collected by cystocentesis and analyzed immediately; false results can be obtained with cooled urine) are used in the diagnosis of CKD.

Additional measures include testing for leptospirosis (ideally 2-week then 4-week titer intervals or polymerase chain reaction [PCR]); tick-borne diseases (titers or PCR), including babesiosis (*B. canis or B. gibsoni*; PCR testing is most sensitive) and *Borrelia burgdorferi*. *B. burdorferi* infection has been associated with azotemia, but the pathophysiology has not been established. It is known that seropositive dogs can demonstrate no illness from the exposure; therefore, testing must be interpreted judiciously. The 4Dx test (IDEXX) tests for the C6 antibody and is both sensitive and specific for *Borrelia* exposure.

Ethylene glycol test must be done within 48 hours of possible ingestion. For plasma zinc testing, use royal blue top tubes. Other tests include indirect arterial blood pressure for hypertension, abdominal radiography for potential uroliths or neoplasia, ACTH stimulation testing for Cushing's disease, serum total T4 and TSH or full thyroid panel for hypothyroidism, and blood and urine glucose for primary or concurrent diabetes mellitus. Advanced testing could include ultrasonography, dual energy x-ray absorptiometry (DEXA) analysis for lean body mass to fat mass ratio, and blood gas analysis.

Pathophysiology

Obesity occurs when caloric intake exceeds the dog's energy requirements, such as basal metabolic rate, exercise and other energy expenditures. Obesity is a disease with increases in inflammatory mediators, insulin resistance and abnormal blood lipids. Diseases such as diabetes mellitus, cardiovascular changes, pancreatitis, lipidosis, osteoarthritis, cancer, constipation, and lower urinary tract disease have been associated with obesity. Obesity does not cause renal failure, but these conditions are associated. The multiple effects of obesity suggest a link between obesity and renal failure although the exact pathophysiology is not known. Epidemiologically both obesity and renal failure are increasing at similar rates in dogs. Early glomerular changes have been documented in obese human beings. Low birth weight babies have a higher risk of reduced nephron numbers, obesity, and hypertension.

Signalment

Obesity occurs most often in dogs between 5 and 10 years of age. These obese dogs are at a greater risk of early morbidity and mortality. Renal failure in young dogs can result from dietary indiscretion (zinc, lilies, raisins, grapes, antifreeze, and other medications). Glomerular disease is the leading type of renal failure in dogs; it is most frequently seen in male dogs with a mean age of 8 years of age or older. Dogs with diabetes mellitus are often obese and have an increased risk of developing renal failure. The Shar-Pei breed is predisposed to renal failure involving amyloid deposition in the glomerular and medulla of the kidneys. Fanconi syndrome in Basenjis often progresses to renal failure. Congenital renal failure has been described in many breeds and usually manifests in dogs less than 3 years of age.

Key Nutrient Modifications

Low-phosphorus diets have been shown to slow progression of renal failure. Moderate levels of high-quality protein are beneficial in slowing progression of renal failure in cats. High dietary intake of omega-3 fatty acids has anti-inflammatory effects in primary renal failure. Diets with moderate restriction of sodium may decrease systemic arterial hypertension and degree of azotemia.

Antioxidants play a role in obesity-related inflammatory mediators and increased oxidative stress on normal cell function; therefore, diets fortified with balanced antioxidants will be beneficial. Low-calorie diets must provide all essential nutrients balanced to the calorie intake. Low-fat diets decrease dietary calorie content because fat provides two times more calories per gram than protein or carbohydrates. High-fiber diets are used to decrease caloric intake and increase satiation for weight loss and improve gastrointestinal health in renal patients. Canned diets with more water may increase satiety and improve fluid balance in renal patients.

Recommended Ranges of Key Nutrients

Nutrient	% DM	g/100 kcal	% DM	g/100 kcal
	Recommended dietary level		Minimum dietary requirement*	
Phosphorus	0.2–0.4	0.04–0.1	0.5	0.14
Sodium	0.1–0.35	0.02–0.12	0.06	0.02
Protein	13–20	3.5–5.5	18	5.1
Fat	6–11	1.5–3.0	5	1.4
Fiber	9–22	2–7	n/a	n/a

Modified intake of these nutrients may help address metabolic alterations induced by disease states. The recommended dietary composition is shown as percent of dietary dry matter (DM) and as g or mg per 100 kcal metabolizable energy. All other essential nutrients should meet normal requirements adjusted for life stage, lifestyle, and energy intake.
*Nutrient requirement for adult animals as determined by the Association of American Feed Control Officials

Therapeutic Feeding Principles

- Renal failure is the primary management concern. It requires strict phosphorus restriction and moderate high quality protein intake that has been shown to slow progression of this disease.
- Renal diets tend to be higher in fat and lower in fiber content to ensure adequate caloric intake; dogs with renal failure often have poor appetites and concurrent gastrointestinal disease.

- The high fat levels in renal diets can improve palatability, but can cause gastrointestinal issues such as pancreatitis.
- Obese dogs require low calorie, low fat, and moderate to high fiber diets, but the palatability of these diets can be poor in dogs with renal failure
- The dietary goal of managing an obese dog with renal failure is to ensure adequate caloric intake for weight maintenance and safe weight loss; this weight loss diet must be low in phosphorus with moderate high quality protein levels to slow renal failure progression

■ **Treats –** Avoid table scraps and human foods. Avoid treats that are high in protein, salt or phosphorus (% ash), calories, and fat.

■ **Tips for Increasing Palatability –** Some dogs prefer canned foods; mix appropriate canned and dry foods. Warm canned foods or offer fresh. Add low-salt, low-fat broth or low-salt tuna water to diet. Offer small meals frequently.

■ **Diet Recommendations –** Diets that meet the following criteria are recommended: Low phosphorus, moderate high-quality protein, moderate sodium, low fat, moderate to high fiber, and high omega-3 content.

Client Education Points

- Management of CKD may supersede a weight loss program for bese dogs in renal failure.
- Close monitoring of weight is paramount in obese dogs with renal failure. Monitoring includes body condition scoring and body weight.
- Dogs in renal failure can easily lose weight in the form of lean body mass rather than fat, which is a poor prognosis for survival.
- "Eating some" is not enough; the dog must consume enough for maintaining weight or achieving safe weight loss if this is a goal.
- Monitor renal values closely if weight loss occurs.
- Weight loss can signify dehydration and/or the progression of renal failure.
- Malnutrition is a major cause of morbidity and mortality in dogs with renal failure.

Common Comorbidities

Bacterial urinary tract infection (cystitis or pyelonephritis), nephrolithiasis (usually calcium oxalate), diabetes mellitus, hypothyroidism, hyperparathyroidism, pancreatitis, inflammatory bowel disease, colitis, and osteoarthritis are seen in obese dogs with renal failure.

Interacting Medical Management Strategies

Angiotensin-converting enzyme (ACE) inhibitors are used to decrease proteinuria, but may induce hyperkalemia. **Amlodipine** is used to decrease systemic arterial hypertension, but may induce hypotension. **Phosphate binders** are used to decrease hyperphosphatemia, but may cause constipation, hypercalcemia, or hypophosphatemia depending on the type used. **Calcitriol** is used to treat renal secondary hyperparathyroidism, but may induce hypercalcemia. **Antibiotics** used to treat bacterial infections may be nephrotoxic (e.g., aminoglycosides). **Nonsteroidal anti-inflammatory drugs (NSAIDs)** used to decrease inflammation may be nephrotoxic. **H2 blockers** (e.g., metoclopramide or ranitidine) are used to decrease nausea, vomiting, and gastrointestinal ulceration and bleeding but may cause sedation or hyperactivity in rare cases. **Recombinant human erythropoietin (EPO)** is used to correct anemia, but can cause anti-EPO antibodies leading to a nonregenerative anemia. **Potassium salts** (e.g., gluconate or citrate) is used to treat hypokalemia or metabolic acidosis, but may induce hyperkalemia especially when used with an ACE inhibitor. **Omega-3 fatty acids** used to decrease inflammatory response can increase caloric intake. **Sodium bicarbonate** is used to treat metabolic acidosis, but is unpalatable for cats and may increase blood pressure due to increased sodium intake.

Monitoring

Adequate **hydration** is needed to maintain renal perfusion. Many dogs with CRD require supplemental fluid administration, including feeding canned diets that contain more than 75% moisture; oral administration of water or flavored fluids; subcutaneous administration of lactated Ringer's solution or other balanced crystalloid solution; or enteral administration of water by feeding tube.

Maintain a stable **creatinine** concentration. Clinical signs do not often correlate with the degree of azotemia in dogs with CRD because they have adapted to it. Creatinine concentrations that increase by more than 0.2 mg/dL between measurements in dogs with CRD that are adequately hydrated indicates progression.

A **urine protein:creatinine ratio** (UP:UC) maintained below 0.5 is ideal. UP:UC ratios should be followed serially; interpretation is dependent on absence of hematuria, pyuria, or infection. ACE inhibitors should be administered to dogs with chronic renal failure with UP:UC ratios greater than 0.5.

Phosphorus levels should be maintained below 5.5 mg/dL. Phosphate binding agents can be used to initiate treatment if levels continue to increase.

Blood pressure (systolic) should be less than 160 mmHg, and should be measured serially over weeks or months. Initiate treatment if blood pressure continues to increase; slowly lower sodium intake further if levels are moderate. In dogs on ACE inhibitors and/or amlodipine therapy, increases in creatinine > 0.5 mg/dL suggest an adverse drug reaction. ACE inhibitors or amlodipine should never be given to a dehydrated patient.

Hematocrit should be maintained between 38% and 48%. The use of recombinant human EPO or darbepoetin may be appropriate. Other factors, such as gastrointestinal ulcerations, iron deficiency, poor nutrition, hyperparathyroidism, and infections, should be considered in anemic dogs.

Serum potassium levels should be between 3.5 and 5.5 mEq/L. **Hypokalemia** can be treated with oral potassium gluconate or citrate. For **hyperkalemia,** decrease dietary intake of potassium and consider reduction in dosage of ACE inhibitors or potassium supplement. If **metabolic acidosis** is not controlled by diet, initiate treatment with oral sodium bicarbonate or potassium citrate.

Malnutrition is a concern; an obese dog with CKD that experiences rapid weight loss (more than 1% to 2% body weight per week) is losing lean muscle mass (which can increase azotemia) in addition to fat or is severely dehydrated. Enteral feeding tubes should be considered to supply enough calories to prevent rapid weight loss. The enteral diet should be formulated with adequate calories, but low in phosphorus, sodium, and moderate high-quality protein or as necessitated by the patient and renal staging. Aggressive rehydration via intravenous fluid administration is needed.

See Algorithm: Nutritional Management of Concurrent Canine Obesity and Chronic Kidney Disease on page 114.