FELINE chronic renal disease (CRD) is extremely common, affecting approximately six per
cent of all cats and more than 15 per cent of cats aged 15 years or more. The mean age of
presentation in the UK is 12 to 13 years.

Affected cats suffer a progressive and irreversible deterioration of renal function, with eventual
failure and the inability to maintain normal excretory function. This article will discuss the causes of
renal insufficiency and possible management strategies for cats suffering from chronic disease.

To establish an appropriate treatment protocol in an animal showing clinical and laboratory
evidence of renal dysfunction, the veterinary surgeon must first differentiate those animals with
acute renal failure from those with chronic disease.

The latter group should then be further divided into those with compensated and those with acutely
decompensated renal failure. This is important because the prognosis in acutely azotaemic cats
with advanced chronic renal failure (CRF) is extremely poor, unless an initiating factor can be
identified and managed aggressively.

The diagnosis of CRF is often based on clinical signs, the presence of azotaemia (elevations in
plasma urea and/or creatinine levels) and reduced urine concentrating ability. Affected cats often
retain some concentrating ability, but a urine-specific gravity of less than 1.035 in the presence of
azotaemia is usually considered diagnostic. A urine protein-to-creatinine (UPC) ratio is the most sensitive detector of proteinuria and should always be conducted in suspect animals. Levels above 0.4 are considered abnormal and are associated with a poor prognosis.

Once the clinician has diagnosed renal insufficiency, a decision must be made as to whether further investigation to determine the actual cause of the renal dysfunction is appropriate. It is beyond the scope of this article to discuss diagnostic procedures, except to mention that renal biopsy is the most useful test and prognostic indicator, although the risks involved with this procedure in affected animals often preclude its use.

**Causes**

The aetiology of chronic renal insufficiency (CRI) in many cats remains obscure, but histopathological findings in affected cats often include a chronic interstitial nephritis characterised by progressive fibrosis, sterile inflammation and loss of nephrons. The cause of these changes is unknown, although chronic pyelonephritis or glomerulonephritis has been implicated in some cases. It should be noted that feline CRF is a predominantly tubulointerstitial disease with glomerular involvement, rather than a primary glomerular disease.

Polycystic kidney disease (PKD) is seen most commonly in Persians and long-haired cats, and can be detected by renal ultrasonography in kittens as young as seven weeks of age. In PKD, cortical and medullary cysts increase in both number and size, resulting in the progressive loss of functional renal tissue. Cysts are usually detectable by the age of six to 12 months.

Renal and/or ureteral urolithiasis has been detected in a number of cats with CRF in North America. At present, it is unclear whether the calculi are responsible for the renal failure, a consequence of renal failure or a result of underlying processes responsible for the renal failure.

Renal lymphoma may be bilateral, and affected kidneys are often smooth or irregularly enlarged. FeLV status is generally negative in these cats unless other organs are involved. A fine-needle aspirate will usually confirm the disease.

Hyperthyroid cats with marginal renal function may develop azotaemia following treatment, and serum biochemistry should be undertaken at regular intervals during the introduction of treatment for the hyperthyroidism. Thyroidhormones support glomerular filtration by increasing renal perfusion; consequently, a reduction in hormone levels leads to a decrease in those parameters and the development of azotaemia. It should be noted that serum creatinine levels will often increase slightly as a result of improved muscle mass when these animals achieve an euthyroid state.

Primary glomerular disease is a less common cause of advanced renal failure in cats than in dogs. When presented, affected cats should be tested for FIV and FeLV, because chronic antigenic
stimulation is often implicated in the development of glomerulonephritis.

Amyloidosis shows a breed predisposition, with Siamese, oriental shorthairs and Abyssinians over-represented. The disease does occur occasionally in other breeds, but there is great variability in the age of onset and severity of renal involvement. Affected Abyssinian cats may be diagnosed with the disease as early as four to six months of age, although some are not diagnosed until later.

Amyloid is deposited preferentially in the renal medulla and, to a lesser degree, in the glomeruli. For this reason, fine-needle aspirates (which often sample cortical tissue alone) may miss the disease. Diagnosis is best reached by examining a wedge biopsy obtained by laparotomy, or perhaps endoscopy. A genetic cause is suspected and the prognosis in affected cats is invariably poor.

A significant number of cats with CRF (20 to 30 per cent) have positive urine cultures, although they may not always display clinical signs of a urinary tract infection. It is not yet known whether the infection causes renal dysfunction or if it occurs secondarily to changes within the urinary tract, but it is generally agreed that an infection, if present, should be treated.

Food-associated renal failure has been recognised but the incidence is unknown. Since the supplementation of commercial pet foods with potassium, kaliopenic nephropathy is less frequently encountered.

Other causes include urinary tract obstruction and toxic damage from medications, such as NSAIDs and aminoglycoside antibiotics. Lily component ingestion is a common cause of renal failure in USA-based cats.

**Staging**

It is often difficult to identify the cause of CRF in many older cats presenting with mild azotaemia and the classically vague reduction in bodyweight and appetite. However, cats aged 10 years or younger should be investigated to give the owner a more accurate idea of prognosis. Such investigation should always include haematology, biochemistry and a complete urinalysis. Ultrasonography, radiography and renal biopsy may also be of value.

Creatinine is a product of muscle metabolism and is freely filtered by feline tubule epithelium. Unlike plasma urea concentrations, creatinine concentrations provide a crude index of glomerular filtration rate (GFR) and are less affected by nonrenal factors, although there are limitations to its use.

Plasma creatinine levels do not reliably detect renal dysfunction until 75 per cent of functional renal mass has been lost, and levels do not give a precise indication of the severity of renal dysfunction. Urinary clearance of exogenous markers gives a more reliable indication of renal function, but its
use is presently limited primarily to research laboratories.

The International Renal Insufficiency Society (IRIS) has proposed a staging system for dogs and cats, based on plasma creatinine concentrations. These values should not be considered absolute cut-off points, as creatinine levels may be affected by individual variables.

The system is designed to facilitate a standardised approach to the management of cases presenting at a particular stage of the disease. Cases can be further sub-staged, depending on the presence of proteinuria and hypertension.

- **Stage one (non-azotaemic).**

  Creatinine levels are less than 140mmol/L. These cats are often asymptomatic, but may have renal abnormalities or reduced urinary concentrating ability.

- **Stage two (mildly azotaemic).**

  Creatinine levels are between 140mmol/L and 250mmol/L. Clinical signs are mild or absent.

- **Stage three (moderately azotaemic).**

  Creatinine levels are between 251mmol/L and 439mmol/L. Numerous clinical signs may be present.

- **Stage four (severely azotaemic).**

  Creatinine levels are greater than 440mmol/L. Numerous extra-renal signs may be present.

**Management**

Management of affected cats falls into three main categories: specific, renoprotective and symptomatic treatments. If an underlying cause of CRI can be identified, specific treatments (such as antibiotics, chemotherapy or fluid therapy) may halt or slow the rate of nephron loss. As the disease progresses and the classic signs of azotaemia (vomiting, stomatitis, diarrhoea and anorexia) become evident, there is a greater requirement for the symptomatic and supportive therapies discussed below.

- **Adequate hydration maintenance**

  Despite the obligatory polydipsia associated with CRF, affected cats often present with variable degrees of dehydration. This, in turn, leads to poor renal perfusion and reduced renal function. If water intake is reduced for any reason, cats with CRF may decompensate acutely due to volume depletion. These cats require immediate intravenous fluid therapy.

  In many cases, affected cats experience recurrent episodes of dehydration and owners should be
aware of the cat’s need for free access to water. Water intake may be encouraged by several means, including: feeding moist foods; supplementing the diet with water; provision of running water (such as pet fountains); improving water palatability with the addition of flavourings; and, in some cases, the administration of subcutaneous fluids at home by the owner.

- **Dietary modifications**

Dietary phosphorus restriction has been shown to exert a renoprotective effect, slowing the progression of renal failure. This occurs as a result of direct reduction in circulating phosphate levels and an indirect reduction in parathyroid hormone (PTH) levels. The reduction of PTH is important because although it is a normal physiological response to persistent hyperphosphataemia, raised levels may result in the development of secondary renal hyperparathyroidism and abnormal deposition of calcium, causing damage to renal and other tissues.

The restriction of dietary protein in cats with CRF may slow the progression of renal failure. However, the primary benefit is the lessening of clinical signs associated with the uraemic syndrome. It should be noted that there is a direct relationship between dietary protein and phosphate levels, and diets low in protein will often be correspondingly low in phosphate.

The importance of sodium in CRF remains unclear. Traditionally, sodium levels have been restricted in the belief that high intake would lead to hypertension and renal damage. It has been demonstrated that cats with CRF fed a diet high in sodium showed increased levels of circulating urea, creatinine and phosphorus. However, this did not appear to be related to changes in systolic or diastolic blood pressure. Low sodium intake may be associated with a reduced GFR, increased potassium loss via kaliuresis and activation of the renin-angiotensinaldosterone system.

The use of a renal diet may double the survival time in cats, making it one of the most useful management strategies in these patients. An effective renal diet is restricted in both protein and phosphorus, and the protein source should have a high biologic value. Sodium levels are often 0.2 to 0.3 per cent. Several commercial options are available in the UK. Home-cooked recipes may also be considered, but these have not been rigorously evaluated.

Cats in the advanced stages of CRF are often anorexic, which may present difficulties when introducing a new diet. Food aversions are common in anorexic cats, so the new diet should not be introduced until the animal has regained a normal appetite. Initially, the renal diet should be offered in a separate bowl to the usual diet at normal feeding times. After a few days, offer the regular food only if the new food is refused, gradually decreasing the amount of the regular food offered over a four-to-six-week period. Regular communication with the client may be necessary to ensure compliance.

Hypokalaemia as a result of increased kaliuresis is present in an estimated 15 to 20 per cent of
cats with CRF. Clinical signs are rarely seen until serum levels fall below 3mmol/L, but moderately reduced levels may contribute to renal damage and worsening of the renal failure. Mechanisms include hypokalaemia-induced renal vasoconstriction, reduced responsiveness to vasopressin and increased renal production of ammonia, which contributes directly to interstitial nephritis. Hypokalaemia may also aggravate metabolic acidosis and hypertension. Supplementation with potassium salts is recommended when serum levels fall below 4mmol/L.

• **Phosphate binders**

If the hyperphosphataemia (fasted serum levels less than 2mmol/L) associated with CRF do not resolve with dietary restrictions, consider the use of an oral phosphate binder.

Aluminium hydroxide has been withdrawn from the market over toxicity concerns, but sevelamer and lanthanum carbonate (both used in human medicine) show promise in cats. Chitosan, in combination with calcium carbonate, is available in the UK as an oral supplement.

• **Control of hypertension**

Systemic hypertension in cats occurs in up to 60 to 70 per cent of cats with CRF and may contribute to glomerular damage in addition to cardiac, ophthalmic and neurological abnormalities.

Cats with systolic blood pressure readings above 170mmHg and those with ocular lesions suggestive of hypertensive retinopathies may benefit from treatment with a calcium-channel blocker, such as amlodipine (0.625mg/cat to 1.25mg/cat sid PO). However, blood pressure should be monitored regularly to ensure hypotension and subsequently reduced renal perfusion does not occur.

ACE-inhibitor therapy improves both quality of life and longevity in affected cats – less through anti-hypertensive activity and more through its ability to reduce proteinuria. High UPC ratios are consistently associated with a poor prognosis. In particular, cats with a UPC greater than one benefit significantly from the administration of an ACE-inhibitor. Benazepril is most commonly used.

• **Other measures**

Cats displaying clinical signs associated with hypergastrinaemia (vomiting, anorexia and inappetence) may benefit from the use of H2-receptor antagonists, such as cimetidine, ranitidine or famotidine, or proton pump inhibitors, such as omeprazole.

Anti-emetics, such as metoclopramide, may be of use if vomiting persists, despite the use of the above medications.

If gastric ulceration is suspected, sucralfate may alleviate associated signs, such as pain and
nausea. It should be given three to 60 minutes before other medications. Cats with poor appetites may respond to the administration of an appetite stimulant. The most commonly used is cyproheptadine, an antihistamine with antiserotonin effects. Benzodiazepines should be used with caution.

Many cats with CRF display a non-regenerative anaemia, as the damaged kidneys fail to produce adequate amounts of erythropoietin. Cats with a PCV less than 20 per cent may benefit from the subcutaneous administration of recombinant human erythropoietin (HuEPO) and iron supplementation. Blood pressure should be monitored closely during treatment. Up to 30 per cent of cats will develop antibodies to the HuEPO and acute severe anaemia. These cats can no longer receive HuEPO and will require blood transfusions for life.

**Conclusion**

Feline chronic renal disease is commonly encountered in veterinary practice and, despite the aetiology often remaining obscure, appropriate treatment strategies can provide these cats with long and comfortable lives.

Therapeutic measures include the maintenance of normal hydration and attention to the metabolic abnormalities (hyperphosphataemia, azotaemia and hypokalaemia) often present in these patients.

Anti-hypertensives and ACE inhibitors – used alone or in combination – have important roles in preserving renal function and improving quality of life.

• References are available by request to the editor. For more published *Veterinary Times* articles on renal conditions or felinerelated problems, visit [www.vetsonline.com](http://www.vetsonline.com)
Investigation of renal failure should include a complete urinalysis. However, in-house urinalysis has limitations and a urine protein-to-creatinine ratio is recommended whenever renal disease is suspected.
Systemic hypertension occurs in up to 60 to 70 per cent of cats with CRF, and may contribute to glomerular damage. Cats with systolic blood pressure readings above 170mmHg may benefit from treatment with a calcium-channel blocker, such as amlodipine.
Chronic renal disease affects approximately six per cent of all cats, and more than 15 per cent of cats aged 15 years or more. However, with appropriate management, many of these animals will enjoy a good quality of life.
Cats with chronic renal failure may decompensate acutely, often because of a period of reduced water intake. These cats require immediate intravenous fluid therapy.