

RENAL DISEASES OF IN CATS

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SUMMARY

Slightly more than 50% of cats with chronic kidney disease (CKD) have chronic interstitial nephritis of unknown etiology. Several other clinically and histologically identifiable diseases account for remaining cases of CKD in cats, and clinicians should be aware of the clinical features and prognosis of these other feline renal diseases.

POLYCYSTIC RENAL DISEASE

Polycystic kidney disease was first described in adult male and female long-haired, Persian-type cats in the late 1960's. In 1996, the disorder was shown to be inherited as an autosomal dominant trait in a family of Persian cats. Both male and female cats were affected. In affected × unaffected crosses, 42% of offspring were affected and 58% were unaffected. In affected × affected crosses, 73% of progeny were affected and 27% were unaffected. These results were consistent with autosomal dominant transmission. Recently, the prevalence of autosomal dominant polycystic kidney disease (ADPKD) in Persian cats has been reported to be approximately 28% in the United Kingdom, based on results of a genetic assay using a single nucleotide polymorphism in exon 29 of the polycystin gene.

Many young Persian cats with ADPKD are asymptomatic, and renomegaly is recognized as an incidental finding on physical examination with confirmation of renal cysts by abdominal ultrasonography. The kidneys of cats with ADPKD become progressively enlarged and irregular over time as the cysts increase in number and size. Renal failure usually does not develop until 7 or 8 years of age. Some affected cats appear outwardly normal for many years, and clinical signs of renal failure can seem to the owner to appear relatively abruptly. Clinical signs in cats with ADPKD and chronic renal failure include polyuria, polydipsia, anorexia, weight loss, poor hair coat and lethargy. On physical examination, enlarged irregular kidneys can be palpated. Laboratory findings in ADPKD cats in renal failure include azotemia, hyperphosphatemia, isosthenuria, nonregenerative anemia, and metabolic acidosis.

A skilled ultrasonographer can detect cysts during renal ultrasound examination in affected cats as young as 6 to 8 weeks of age. In one study, renal ultrasonography had a sensitivity of 75% when performed at approximately 4 months of age and a sensitivity of 91% when performed at approximately 9 months of age. The cysts are smooth, round, anechoic and characterized by distal acoustic enhancement. Cyst size and number vary greatly among affected cats, and cysts increase in number and size over time. Although genetic testing is available, ultrasonography is the most readily available diagnostic test to identify ADPKD in Persian cats. The ability to detect the disease before sexual maturity (whether by genetic testing or ultrasonography) provides an opportunity to eliminate this disorder from the breed by careful genetic counseling.

On pathologic examination, multiple cysts of varying size are found in the renal cortex and medulla of the kidney. Lymphoplasmacytic interstitial inflammation and fibrosis also may be observed. The cysts arise from both proximal and distal segments of the nephron. Hepatic cysts occasionally have been observed, and rarely pancreatic cysts have been detected. Treatment of ADPKD in affected Persian cats is limited to control of hypertension if present and medical management for chronic renal failure. Enalapril or amlodipine can be used for blood pressure control in affected hypertensive cats.

AMYLOIDOSIS

Spontaneous systemic amyloidosis is uncommon in the domestic cat, but occurs as a familial disease in the Abyssinian, Siamese and Oriental Shorthair breeds. Affected Abyssinian cats usually are presented between 1 and 5 years of age, and amyloid deposits first appear in the kidneys of affected Abyssinian cats between 9 and 24 months of age. In some of these cats, amyloid deposition is rapid and severe and renal failure develops within one year of diagnosis. In others, amyloid deposition in the kidney is mild, and affected cats may live to an advanced age without detection of their amyloid deposits. Such mildly affected cats likely transmit and maintain the disorder in the affected breeds. The mode of transmission of amyloidosis in Abyssinian cats has been difficult to establish because no ante-mortem gold standard of diagnosis exists. The amyloid deposits in affected Abyssinian cats are composed of amyloid A protein, an amino terminal degradation product of the acute phase reactant serum amyloid A protein.

Abyssinian cats with familial amyloidosis usually are presented for poor hair coat, weight loss, polydipsia, polyuria, lethargy, and anorexia. Physical examination findings include dehydration, pallor of mucous membranes, gingivitis, and kidneys that are small, firm, and irregular on abdominal palpation. Laboratory evaluation usually reveals evidence of chronic renal failure including azotemia, hyperphosphatemia, metabolic acidosis, nonregenerative anemia, and isosthenuria. Proteinuria is a variable finding and reflects the severity of glomerular involvement. In Siamese and Oriental shorthair cats with amyloidosis, large amyloid deposits in the liver may lead to hepatic rupture and spontaneous hemoabdomen necessitating emergency abdominal exploration to control hemorrhage.

The diagnosis of amyloidosis requires proper pathologic evaluation (e.g. Congo red staining) of an adequate biopsy specimen. A wedge of kidney containing both cortical and medullary tissue obtained at laparotomy is more likely to yield a definitive diagnosis because of the prominent medullary distribution of renal amyloid deposits. Despite a conscientious effort to obtain an adequate renal biopsy sample, results can be negative in affected cats if no glomerular amyloid deposits are present and only small deposits are present in the renal medullary interstitium. Treatment of amyloidosis is limited to symptomatic therapy of chronic renal failure. Underlying inflammatory disease is uncommonly detected, but any concomitant infections should be treated appropriately.

PYELONEPHRITIS

Pyelonephritis refers to interstitial inflammation, often most severe in the renal pelvis and adjacent medullary tissue, associated with bacterial infection of the kidney. In general, bacterial urinary tract infection is less common in the cat than in the dog, and the importance of ascending infection and obstructive nephropathy in the pathogenesis of pyelonephritis in the cat is not clear. Pyelonephritis in cats may result in fever, anorexia, lethargy, dehydration, and weight loss. Such clinical signs are not expected in all affected animals and may be present for only a short period of time, making recognition of the chronic pyelonephritis difficult. Depending on the extent of renal parenchymal involvement, azotemia, hyperphosphatemia, nonregenerative anemia, and metabolic acidosis also may be found. Fever, leukocytosis, and pain on palpation of the kidneys may be observed in cats with acute pyelonephritis. Unfortunately, fever may be absent, urinalysis findings may be nonspecific, and urine cultures may be negative in cats with chronic pyelonephritis. Renal ultrasonography or excretory urography may show dilatation of the renal pelvis and diverticula or decreased renal size. Treatment consists of bactericidal antibiotics (for 4 to 8 weeks) to eradicate the infection, definitive therapy to remove any predisposing factors (e.g. calculi, obstruction), and fluid therapy to restore and maintain hydration. The prognosis is good if predisposing factors can be eliminated and if treatment is instituted before the development of endstage renal disease.

GLOMERULONEPHRITIS

In most reports of glomerulonephritis in the cat, no predisposing factors have been found and the disease has been classified as idiopathic. Young adult male cats typically are affected and no breed predisposition has been identified. The clinical presentation falls into two categories: classical nephrotic syndrome characterized by subcutaneous edema, ascites, proteinuria, hypercholesterolemia, and hypoalbuminemia without marked azotemia and chronic renal failure with azotemia. Laboratory abnormalities in cats with GN include proteinuria, hypoalbuminemia, hypercholesterolemia, and nonregenerative anemia. The presence of azotemia and hyperphosphatemia is variable depending on the presentation.

Histologically, the lesions are those of membranous nephropathy with immunoglobulin G and complement deposition. An attempt should be made to diagnose and treat any underlying disease process (e.g. feline leukemia virus infection, feline infectious peritonitis) that might have resulted in the development of glomerulonephritis. Cats with edema and ascites but without azotemia may be treated with furosemide and prednisolone but there is no evidence to show that corticosteroid therapy alters outcome. Enalapril can be used to treat hypertension and may have additional beneficial effects (e.g. reduction of proteinuria, slowed rate of disease progression). Cats with azotemia and endstage renal disease due to glomerulonephritis should be treated by medical management for chronic renal failure.

The prognosis for cats with glomerulonephritis is variable. The disease may be slowly progressive, but remissions also are observed. Cats with endstage renal disease secondary to glomerulonephritis have the shortest survival times (a few weeks to a few months). Non-azotemic cats presented with nephrotic syndrome do better and survive several months to several years.

CHRONIC INTERSTITIAL NEPHRITIS OF UNKNOWN ETIOLOGY

Chronic interstitial nephritis is a common morphologic diagnosis and may represent the end result of several different renal diseases including chronic glomerulonephritis and chronic pyelonephritis. In most patients, however, the inciting cause of the progressive renal disease cannot be determined.

The most common historical findings in cats with endstage renal disease are weight loss, anorexia, and lethargy. Polyuria, polydipsia, and vomiting are detected less commonly by owners. Physical examination may show poor hair coat, emaciation, pallor of mucous membranes, and dehydration. The kidneys are small, firm, and irregular on abdominal palpation. Laboratory findings include nonregenerative anemia, azotemia, hyperphosphatemia, metabolic acidosis, hypokalemia, and isosthenuria. Except for urine specific gravity, urinalysis findings in cats with endstage renal disease generally are unremarkable but up to one-third of cats with chronic renal failure may have bacterial urinary tract infection. It is thought that low urine specific gravity predisposes cats with chronic renal failure to bacterial urinary tract infection. Although most cats with endstage renal disease have isosthenuria, some retain substantial urinary concentrating ability. The prognosis for cats with chronic renal failure is very variable and the disease appears to progress at different rates in different patients. Affected cats may live several months to years with conservative medical management.

FELINE INFECTIOUS PERITONITIS

The non-effusive form of the coronaviral disease, feline infectious peritonitis often affects the kidneys, liver, mesenteric lymph nodes, central nervous system, and eyes. Renal involvement occurs in many affected cats, and they may be presented for evaluation of enlarged, irregular kidneys. Cats with non-effusive FIP and renal involvement may be presented for vague signs of systemic illness such as fever, lethargy, anorexia, and weight loss. With extensive renal involvement, however, signs referable to renal insufficiency (e.g., polydipsia, polyuria) also may occur. Physical examination reveals irregular, enlarged firm kidneys and other findings suggestive of feline infectious peritonitis may be present (e.g., uveitis, chorioretinitis, enlarged mesenteric lymph nodes, neurologic abnormalities). A presumptive diagnosis of renal feline infectious peritonitis can be made by fine

needle aspiration of the enlarged kidney and observation of pyogranulomatous inflammation consisting of a mixture of neutrophils, macrophages, lymphocytes, and plasma cells.

RENAL LYMPHOSARCOMA

Lymphosarcoma is the most common renal neoplasm of the cat. It usually is bilateral and often associated with the alimentary form of the disease. Frequently, clinical signs result primarily from gastrointestinal involvement and the extent of renal involvement is insufficient to cause signs of renal failure. Occasionally, however, renal involvement may be extensive enough to cause renal failure. Cats with renal lymphosarcoma may be presented for anorexia, lethargy, weight loss, polydipsia, polyuria, dehydration, pallor of the mucous membranes, and renomegaly. Azotemia, hyperphosphatemia, proteinuria, isosthenuria, and nonregenerative anemia may be observed on laboratory evaluation. Approximately 50% of cats with renal lymphosarcoma are feline leukemia virus-positive. The diagnosis of renal lymphosarcoma can be made by cytologic examination of a fine needle aspirate of the kidney demonstrating a monomorphic population of immature lymphocytes. Treatment can be attempted using conventional chemotherapy, but the prognosis is poor.

POTASSIUM DEPLETION NEPHROPATHY

Potassium depletion leads to functional and morphologic abnormalities in the kidneys, characterized by decreased glomerular filtration rate and defective renal concentrating ability. Clinical and experimental studies indicate that potassium depletion in cats may result from feeding acidifying diets high in protein and low in potassium. Adjustment of the potassium content of feline diets after recognition of this disorder has resulted in its becoming a very uncommon clinical disorder in small animal practice today. Laboratory evaluation of cats with chronic renal failure and presumed potassium depletion shows moderate to severe hypokalemia (usually < 3.1 mEq/L), increased creatine kinase concentration, azotemia, hyperchloremic metabolic acidosis, variable hyperphosphatemia, and isosthenuria. Histopathologic findings observed in the kidneys of cats with chronic renal failure and presumed potassium depletion include interstitial fibrosis, lymphoplasmacytic interstitial inflammation, tubular dilatation, tubular atrophy, and variable glomerular sclerosis.

Acute treatment requires diligent potassium supplementation by both oral and intravenous routes. Infusion of potassium-containing crystalloid fluids initially may be associated with a decrease in serum potassium concentration as a result of dilution, increased tubular fluid flow in the distal renal tubules, and cellular uptake of potassium. This effect may be minimized by selecting a fluid that does not contain glucose, administering fluids at an appropriate rate, and beginning oral potassium gluconate as soon as possible. Clinical improvement usually is observed within one to three days. Chronic treatment involves oral administration of potassium gluconate. Treatment results in resolution of muscle weakness and hypokalemia, weight gain, improved hair coat, and resolution of anemia. Renal function stabilizes or improves in most instances.

PERINEPHRIC PSEUDOCYSTS

Although not specifically a renal disease, perinephric pseudocysts can easily be confused with renomegaly on routine abdominal palpation. Perinephric pseudocysts are fluid-filled fibrous sacs that surround the kidney but are not lined by epithelium (hence the term *pseudocyst*). They are idiopathic in origin but often occur in association with chronic renal failure in older (> 10 years) cats of both genders (males somewhat more commonly than females) and any breed. Most cats with perinephric pseudocysts have at least mild chronic renal failure and sometimes a long history of chronic renal failure is identified. Occasionally, small kidneys and chronic renal failure are diagnosed prior to development of perinephric pseudocysts.

The presenting complaints may be related to underlying chronic renal failure (e.g. polyuria, polydipsia,

anorexia, and weight loss) but most commonly abdominal distension is the only abnormality detected by the owner. Abdominal discomfort and vomiting are thought to result from very large perinephric pseudocysts. On physical examination, perinephric pseudocysts may be unilateral or bilateral and often are interpreted as renomegaly on physical examination. The right and left kidneys are affected with equal frequency. Other physical signs include emaciation, poor hair coat and dehydration.

Laboratory evaluation discloses findings typical of mild chronic renal failure in many affected cats, and urinary tract infection is very common. Renal ultrasonography is the diagnostic test of choice for this disorder and demonstrates accumulation of anechoic fluid between the capsule and renal parenchyma of one or both kidneys. Fine needle aspiration of the pseudocyst yields a transudate or modified transudate.

Cysts can be drained under ultrasound guidance, but fluid accumulation typically recurs after a few weeks or months. Definitive treatment usually involves surgical resection of the pseudocyst capsule. Rarely, fluid will continue to accumulate in the abdomen after resection of the pseudocyst capsule, suggesting that renal parenchyma is the ultimate source of the fluid. In most cases, however, additional fluid that is produced probably is absorbed by the peritoneum. Treatment by omentalization also has been described and may prevent re-accumulation of fluid in the abdomen. The kidney should not be removed in cats with unilateral perinephric pseudocysts because progression of renal disease in the remnant kidney can be accelerated dramatically and renal failure may worsen rapidly. The ultimate prognosis of cats with perinephric pseudocysts probably is related primarily to their degree of underlying renal dysfunction at the time of diagnosis.

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