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CATS AND KIDNEY DISEASE

Kidney structure and function

Like all mammals, cats have 2 kidneys located in the abdomen just below the lumbar spinal region. Each is normally similar in size and shape to a small apricot. The kidneys are part of the upper urinary tract, while the bladder and urethra are referred to as the lower urinary tract*. The important functions of the kidneys include:

- removal of waste products from the blood to produce urine
- conservation of water
- preserving normal electrolyte (such as sodium and potassium) levels in the blood
- release of erythropoietin, a hormone that stimulates red blood cell production
- maintenance of normal blood volume and blood pressure

Prevalence of kidney disease in cats

This is an extremely common disorder in cats over 10 years of age. In fact, it would be unusual for a 15 year-old cat not to have some kidney insufficiency. All breeds and both sexes are affected equally by geriatric onset kidney disease.

Young and middle-aged cats have a low incidence of detectable kidney dysfunction. Male cats and certain breeds are at increased risk for developing it in association with factors unrelated to aging (see the following page).

Symptoms of kidney disease (also called renal disease)

The most important thing to remember about cats and kidney disease is that in the early stages, these symptoms are usually absent or too subtle to be observed at home.

As little as 30% of normal kidney tissue is required to carry out vital processes, which means up to 70% of the kidney tissue can be damaged before dysfunction begins to occur. As each function diminishes, there are corresponding symptoms that may be associated with it. The table below shows the common progression of kidney dysfunction to kidney failure, and the observed effects:

Problem	Symptom
• loss of ability to concentrate urine resulting in excessive loss of fluid	• increased thirst and increased urine output
• inadequate clearance of waste products from the blood	• depression, decreased appetite, vomiting, weight loss
• decreased activation of vitamin D, causing excess parathyroid hormone levels	• lethargy, decreased appetite, muscle and nerve dysfunction
• dysregulation of normal blood pressure resulting in hypertension (high blood pressure)	• seizures, stroke, blindness, depression, bizarre behavior (e.g., night howling)
• electrolyte imbalances	• muscle weakness, depression, decreased appetite
• inability to maintain normal blood volume	• Dehydration
• decreased production of erythropoietin	• weakness and lethargy from anemia

* It is important to note that symptoms of *bladder* or *lower urinary tract* disease are different than those of kidney disease. Bladder disease (often caused by urinary tract infections, stones, or other irritants) is usually characterized by painful urinations, frequent trips to the litter box with only drops of urine being produced, bloody urine, or abdominal pain.

How do we tell if a cat has kidney disease?

Evaluation of symptoms at home, physical findings, and laboratory testing of blood and urine samples are needed to determine kidney function. These tests usually do not reveal why there is kidney disease, but give us an assessment of the current status so that we can outline a treatment plan to help support renal function and alleviate common symptoms.

In the early stages of kidney disease, there may be no detectable changes at home or on physical examination. For this reason, we recommend laboratory screening of all cats for kidney disease by age 10.

What are the causes of renal dysfunction in cats?

The most common cause of progressive kidney failure in cats is a combination of accumulation of scar tissue, cellular degeneration, and an inflammatory change called *interstitial nephritis*. This is most common in older cats and may be triggered by infections or other injury to the kidneys earlier in life. In most cases, the exact cause cannot be determined.

Older cats may also develop *pyelonephritis*, a bacterial infection of the kidneys. This is more common in cats with pre-existing renal disease (such as interstitial nephritis), because resistance to bacterial colonization is often lost when renal function declines.

Two other commonly encountered problems causing renal insufficiency are tumors of the kidney (lymphomas and adenocarcinomas, mostly) and obstruction of urine flow at various parts of the urinary tract. Tumors are more common in middle-aged to older cats, but urinary obstructions (often because of bladder problems) can occur in cats of any age (more common in males).

A significant cause of sudden kidney failure is ingestion of antifreeze (ethylene glycol). Polycystic kidney disease (PKD) is a genetic condition which occurs more frequently in breeds such as Persians and Himalayans. Symptoms may appear early or late in life.

Determining of the cause of kidney disease

A thorough physical examination by a veterinarian and palpation of (feeling) the kidneys is the most important first step in forming a list of possibilities for the cause of kidney disease. Cats with small kidneys (which can be irregular in contour) are mostly likely to have chronic renal disease characterized by interstitial nephritis. If the kidneys are enlarged and/or irregular, tumors, infection, obstruction and PKD must be considered. Occasionally, cats will have one kidney that is dramatically bigger than the other because the smaller one is not functioning normally and the other increases its size to compensate for this.

Abdominal ultrasound and biopsy of the kidney(s) are usually needed to confirm the primary cause of the cat's kidney disease. However, there are circumstances in which these procedures may not need to be performed in order to make a reasonable conclusion about the cause. Examples of these situations include: presence of a lower urinary tract obstruction, obvious bacterial infection in the urine, and elderly (i.e., over 15 years old) cats with very small kidneys. *An enlarged kidney or kidneys is almost always an indication to perform an ultrasound.*

Is kidney dysfunction reversible?

In most cases, not. Once kidney cells die, they will not regenerate. However, if a problem causing kidney damage is detected before the cells die, sometimes adequate function will be preserved if that problem is corrected (e.g., pyelonephritis, urinary obstruction, etc.)

If kidney dysfunction is irreversible, does that mean there is no treatment?

Absolutely not! Many cats benefit tremendously from therapy designed to help support kidney function. The treatments vary depending on the stage of the kidney disease.

Pyelonephritis

Pyelonephritis is bacterial infection of one or both kidneys. This is a signficant problem in older cats, especially those with some degree of renal dysfunction. Pyelonephritis can cause severe, permanent damage to the kidneys and can be fatal if undetected or untreated. However, if treated appropriately, most cats feel better quickly and permanent injury to the kidneys can be avoided.

Symptoms of pyelonephritis include lethargy, increased water intake and urine output, vomiting, weight loss, abdominal discomfort and fever. Not all cats will have symptoms. We frequently find evidence of pyelonephritis on routine screening of geriatric cats that are apparently healthy at home.

Diagnosis is made by physical exam, urinalysis and blood tests. Cats without evidence of infection in urine may require an ultrasound and kidney biopsy to confirm the diagnosis (this is not always necessary). In a simple case of pyelonephritis, the urine sample typically contains many white blood cells, variable numbers of red blood cells, and bacteria. A culture of the urine sample will help identify which species of bacteria are present.

Kidney Disease and Diet

Kidney dysfunction in cats is not caused by diet, nor is it worsened by diet. We do, however, often recommend diet changes in order to address some of the negative consequences of kidney disease. Our goals of dietary therapy include:

- achieving weight gain in thin cats
- reduction of protein intake to reduce nitrogenous waste products in the blood
- maintenance of normal potassium levels
- rebuilding depleted B vitamin stores
- supplementation of fatty acids
- avoidance of metabolic acidosis
- reduction of phosphorus levels.

Unfortunately, we usually cannot achieve all of these with one diet. The most common obstacle in nutritional therapy of renal disease is that prescription foods which help improve metabolic imbalances often will not result in maintenance of a healthy weight, which is critical to a cat's longevity and sense of well-being.

Because of this dilemma, the general diet recommendations we make are:

- Reduced protein diets should not be fed to thin cats or those with poor appetites - these cats should be fed a high-calorie, palatable food at all times
- Prescription kidney diets are best suited to cats in the early to mid stages of kidney disease but only if their appetites are good and current weight is appropriate

Available diets:

1. Low-protein diets:

Hill's k/d - canned & dry
Walthams' low protein - canned only
Purina CNM-NF - canned & dry
IVD Select Care Modified Formula - canned & dry

2. Moderately low-protein diet:

Hill's g/d - canned & dry

In order to "test drive" these prescription diets, we have prepared a collection of small samples for purchase. If one of the foods passes the taste test, then you can return and buy the whole bag. These foods are only available at veterinary hospitals and not at the pet store.

3. High calorie, palatable diets without protein restriction

All the premium diets, including Iam's, Science Diet, Max Cat
(avoid "Senior" formulas if weight gain is needed)

4. Recovery diets

Hill's a/d (canned only), Eukanuba Maximum Calorie (canned & dry)

A note about cats with a history of bladder disease (i.e., FUS, crystals, etc.):

If your cat had an earlier problem with lower urinary tract disease, he or she may have been placed on an acidifying diet such as Hill's c/d or s/d. These diets can be detrimental (by worsening metabolic acidosis) if kidney disease is now present and are likely no longer needed anyway. Make sure to let us know if your cat is eating one of these diets.

GENERAL THERAPY

Below are our current treatment recommendations for cats with kidney disease:

- *Omega 3 fatty acids* - may help decrease ongoing cellular injury in many forms of kidney disease (due to anti-inflammatory and anti-oxidant properties)
- *Modified protein diets* - these diets can reduce nitrogenous waste products in the blood by providing high biologic value protein (Note: these diets are not recommended for cats that are underweight, have hyperthyroidism, or have diminished appetites!)

- *Phosphate binders* - these medications help trap dietary phosphorus in the intestine so that levels do not increase in the bloodstream. They are most effective when given with a meal.
  Amphojel, Alu-Caps
- *Iron supplementation* - to help provide the building blocks for red blood cells
  Ferrous sulfate, Pet-tinic
- *B vitamin supplementation* - to help replenish B vitamin stores that are depleted by excessive urine output
  B complex, Pet-tinic
- *Erythropoietin injections* - to stimulate red blood cell production
  Epogen
- *Appetite stimulants* - helpful in keeping calorie intake adequate
  Cyproheptadine, oxazepam
- *Gastric acid blockers* - prevents excessive gastric acid caused by kidney dysfunction, decreases nausea and vomiting, improves appetite
  Pepcid AC
- *Anabolic steroids* - these rarely used medications may aid the severely ill cat by improving appetite, stimulating red blood cell production, and decreasing muscle wasting
  Winstrol-V
- *Antibiotics* - needed for a minimum of 4 weeks (and possibly 8 weeks) any time a bacterial component is suspected to be contributing to kidney dysfunction
  Many, including Baytril, Orbax, Amoxicillin, Clavamox, Ditrim
- *Calcitriol* - similar in function to vitamin D, this medication helps maintain normal parathyroid hormone levels cats with mild to moderate kidney dysfunction. By doing so, studies have shown that this medication may actually lengthen life span and improve overall well-being in appropriate cases.
- *Fluid Administration* - when kidneys lose the capacity to conserve fluid, dehydration results. Supplementing fluids reverses dehydration and improves how an animal feels. For severe dehydration, intravenous fluids (in the hospital) are needed. For maintenance of hydration at home, we often teach owners how to give injections of a balanced electrolyte solution under the skin. Supplemental fluids also help reduce the concentration of waste products in the blood.

GENERAL FOLLOW-UP

Monitoring cats with Renal Disease

We recommend that cats with renal disease be evaluated every 3 to 6 months. A physical exam is performed each time. Depending on your cat's status, measurement of systolic blood pressure and blood and urine tests may be indicated. The laboratory values we monitor regularly include:

- *urine specific gravity* - an indication of how well the kidneys are able to concentrate urine
- *blood urea nitrogen* - a waste product generated from protein metabolism which is filtered out by the kidneys
- *creatinine* - a waste product from normal breakdown of muscle tissue which is also filtered out like urea, but is less affected by diet and other variables
- *phosphorus* - normal levels are maintained by two mechanisms that occur in the kidney
- *hematocrit* - a measure of the red blood cell count

Which medications would be beneficial to my cat?

We tailor each treatment plan to the individual cat. Recommendations are based on the following:

- the primary cause of the kidney dysfunction
- the degree of dysfunction
- the presence of other medical problems
- the severity of the symptoms
- the ease with which the cat can be medicated
- the financial and time commitments an owner is able to make to treating the problem
- the prognosis (predicted outcome).

Where does the infection come from?

The types of bacteria that cause pyelonephritis are usually normal inhabitants of a cat's body and do not come from other animals, spoiled food, contaminated water, or dirty litter boxes. The most common bacteria isolated in pyelonephritis are E. coli, but Staph and Strep species also occur. *Cats with pyelonephritis are not contagious to other animals or people.*

E. coli
All animals (including humans) carry millions of strains of E.coli in our intestines which pose no problem unless the bacteria move through the bloodstream and settle in other organs. E.coli may also infect the kidneys this way or by moving up the urinary tract from the anal area.

Other bacteria:
Other intestinal bacteria can cause pyelonephritis just like E. coli. Another significant source of bacteria, however, is in the mouth. Dental disease dramatically increases the risk of pyelonephritis because of overgrowth of bacteria which constantly shower the bloodstream.

At any given time, we all have bacteria floating around in our blood, but our immune system can usually deal with this. In older cats, especially those with pre-existing kidney dysfunction, these defenses are diminished and the kidneys are much more easily colonized by bacteria. If there is an unusually heavy load of bacteria in the bloodstream (eg, a tooth root abscess), this also can overwhelm protective mechanisms.
Cats with existing kidney disease are also much more susceptible to pyelonephritis because they produce dilute urine. Concentrated urine is toxic to many bacteria, so infection is less likely in cats with normal kidney function.

To help identify and prevent pyelonephritis, we advise the following

- perform a urinalysis regularly (at least once a year, more frequently in many cases)
- address dental disease immediately and thoroughly when possible
- use caution with corticosteroids (eg, prednisolone) and other immunosuppressive drugs
- avoid visible fecal soiling of the anal area (more common in overweight cats).

Treatment:
Pyelonephritis is treated with a prolonged (4 -8 weeks), uninterrupted course of antibiotics. Treatment is usually successful, although most cats will still be at risk for recurrence.

It is important to follow through with recommended re-checks, as incomplete or ineffective treatment may result in continuation of the problem.