What is polycystic kidney disease?

Polycystic Kidney Disease (PKD), first reported in 1967, is an inherited disease in Persian and Persian-cross cats. It has also been diagnosed in British Shorthairs, Exotics, Scottish Folds, and Himalayans. It is a slowly progressive, irreversible disease.

What are the signs of PKD?

Even though affected kittens are born with abnormal kidneys, signs of the disease usually do not appear until the cat is between 3-10 years old (average of 7). Some severely affected kittens, though, may die before 2 months of age. The kidneys of kittens with polycystic kidney disease contain small (less than 1/5 inch: 1mm-1cm) cysts. The cysts usually contain a clear or straw-colored fluid, but in some cases may contain blood or become infected. As the cat ages, the cysts become larger and more numerous. As the kidneys become more cystic, the normal kidney tissue is lost, and the kidney is less able to function properly. Kidney failure occurs when the kidneys can no longer keep up with the body's demands.

The most common signs of kidney failure include:

- Changes in urinary habits such as urinating a lot (polyuria)
- Increased water consumption (polydipsia)
- Anorexia (not wanting to eat)
- Depression and listlessness
- Weight loss
- Poor hair coat

The cat may also have:

- Vomiting or diarrhea, which may or may not be bloody
- Ataxia
- Nervous system signs such as seizures or blindness
- Anemia and resulting weakness
- High blood pressure

Although rare, some cats may also develop cysts in the liver. One cat with cysts in the uterus has also been reported.

How is PKD diagnosed?

Kidney failure is generally diagnosed through a urinalysis and a blood chemistry panel. There are many causes of kidney failure, however. To determine if the affected cat has Polycystic kidney disease, an ultrasound examination is generally performed. On palpation, the kidneys may feel enlarged and irregular in shape. DNA testing is available to determine which cats may be at risk for polycystic kidney disease.

An ultrasound can also be used to identify the cysts in the kidney before the animal is showing any signs of disease, even in some kittens as young as 6 weeks of age. Using ultrasound, the diagnosis of PKD in kittens 10 months of age is 98% accurate.

Which cats can get PKD?

PKD is an autosomal dominant inherited disease. This means that a cat only needs one gene for PKD to develop the disease. A cat can inherit the PKD gene from either parent, or both of them. If the cat has one gene for PKD, he is said to be "heterozygous", and if the cat has two genes for PKD, he is said to be "homozygous." If a heterozygous cat is mated with a cat who does not have the genes for PKD, generally half of the offspring would have PKD. In a mating of two heterozygous cats, approximately 3/4 of the offspring would have PKD. A mating of a homozygous cat with any cat will result in all offspring having PKD, since all offspring would receive a PKD gene.

<table>
<thead>
<tr>
<th>P=Gene for PKD</th>
<th>Parent</th>
<th>Offspring</th>
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<tbody>
<tr>
<td>p=No gene for PKD</td>
<td>Heterozygous for PKD (Pp)</td>
<td>with a P gene and PKD</td>
</tr>
<tr>
<td>P</td>
<td>p</td>
<td>PKD</td>
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</tbody>
</table>
Parent with No PKD (pp) | p | pP | pp | 50%
p | pP | pp

P=Gene for PKD p=No gene for PKD

Parent Heterozygous for PKD (Pp) | Parent Heterozygous for PKD (Pp) | Offspring with a P gene and PKD

P | p | 75%

Parent Heterozygous for PKD (Pp) | P | PP | Pp
p | pP | pp

P=Gene for PKD p=No gene for PKD

Parent Homozygous for PKD (PP) | Offspring with a P gene and PKD

P | P | 100%

Parent with No PKD (pp) | p | pP | pp
p | pP | pp

How is PKD treated?

The cysts, themselves, cannot be treated and surgical removal is not feasible since they can be so small and numerous. The cat can be treated for kidney failure, which may include the following:

- Intravenous (IV) or subcutaneous (SQ) fluids may be given to prevent and treat dehydration. Canned foods, which contain more moisture and are often more palatable, may be recommended.
- Routine testing to evaluate the acid/base and electrolyte balances in the blood is often performed and any imbalances treated accordingly. Again, IV and SQ fluids are selected and administered to prevent or treat electrolyte imbalances and acidosis (the pH of the blood is lower - more acidic - than normal). Oral medications can also be given to treat acidosis.
- Since potassium levels are often low in affected cats, oral supplements and/or fluids containing potassium may be given.
- Phosphorous is often elevated, so diets lower in phosphorous, or the administration of medications that can bind the phosphorous may be necessary. Calcium supplements may be necessary to maintain the proper calcium to phosphorous ratio.
- Medications, such as metoclopramide or famotidine, can be given to help control any vomiting.
- Calcitriol is a medication that may be given to slow the progression of the renal failure associated with polycystic kidney disease. Some studies have shown the cats with kidney failure who are taking calcitriol may appear brighter and more alert, have better appetites and live longer.
- Cats with renal failure may develop high blood pressure, and this is treated in several ways. The sodium content of the diet is decreased, and drugs, such as enalapril, can be given. Increasing dietary fatty acids may also help in reducing blood pressure.
• Blood urea nitrogen (BUN) and creatinine, the waste products that result from the normal breakdown of protein, are elevated in cats with renal failure. These waste products are one of the major causes of vomiting and loss of appetite in affected cats. Protein in the diet needs to be restricted to very high quality protein, which produces less waste products when metabolized.

• Cats with renal failure may develop anemia. A hormone, erythropoietin, which stimulates the production of red blood cells, may be administered along with iron supplements.

How can PKD be prevented?

Cat breeders have the major responsibility of reducing the incidence of this disease. To prevent polycystic kidney disease, cats used for breeding should be PKD negative (not have the gene for PKD). To determine this, all cats used for breeding should have an ultrasound examination of the kidneys, and only cats without lesions should be bred. To prevent transmission of the PKD gene to offspring, animals found to have cysts should be spayed/neutered.

Ultrasound cannot distinguish between those cats that are heterozygous or homozygous for the PKD gene. By examining the heritage of the parents and litters they produce, this determination could be made. If a cat is heterozygous, it is theoretically possible to produce a PKD negative kitten if the cat is mated with an unaffected cat, however, 1/2 of the kittens would be PKD positive.

What is the human relevance?

Humans, too, can inherit PKD, with many similar features to the feline type. In humans, 30-60% of those with autosomal dominant PKD (only one gene required for signs of PKD to occur) develop liver cysts, as well as kidney cysts. In humans, treatment can include renal dialysis and transplantation.

In humans there is another form of PKD, called autosomal recessive, in which the person must have two genes for PKD for signs to develop. The two human forms of the disease differ in the age at which signs appear and the type of lesions that are present.