

# Bacterial Infection of the Kidney (Pyelonephritis)

## Basics

### OVERVIEW

- Bacterial infection/inflammation of the kidney (known as “pyelonephritis”)
- More descriptive term is “upper urinary tract infection” as the bacterial infection/inflammation may involve the kidney and urine collecting mechanism, as well as the ureters (the tubes from the kidney to the bladder)
- The upper urinary tract includes the kidneys and ureters; the lower urinary tract includes the bladder and urethra (the tube from the bladder to the outside, through which urine flows out of the body)

### SIGNALMENT/DESCRIPTION OF PET

#### Species

- Dogs
- Cats

#### Mean Age and Range

- Mean age of affected dogs and cats apparently is unknown
- Dogs of any age can be affected
- Cats over 10 years of age are more likely to develop urinary tract infection than cats less than 10 years of age

#### Predominant Sex

- Unknown
- Dogs—urinary tract infection affects more females than males
- Cats—urinary tract infection is uncommon and occurs with similar frequency in males and females

### SIGNS/OBSERVED CHANGES IN THE PET

- Many pets have no signs or have signs of lower urinary tract infection only
- Increased urination (known as “polyuria” or PU) and increased thirst (known as “polydipsia” or PD)
- Abdominal or lumbar pain—uncommon
- Pain upon palpation of kidneys during physical examination
- Fever
- One or both kidneys may be reduced and/or increased in size
- Signs associated with lower urinary tract infection—such as difficult or painful urination (known as “dysuria”);



frequent voiding of small volumes of urine (known as “pollakiuria”); urinating in inappropriate locations (known as “periuria”); straining with slow, painful discharge of urine (known as “stranguria”); blood in the urine (known as “hematuria”); and malodorous or discolored urine

## CAUSES

- Usually, bacterial infection moving up the urinary tract from a lower urinary tract infection; most common bacteria are *Escherichia coli* and *Staphylococcus*; other bacteria, including *Proteus*, *Streptococcus*, *Klebsiella*, *Enterobacter*, and *Pseudomonas*, which frequently infect the lower urinary tract, may move up into the upper urinary tract.
- Anaerobic bacteria (bacteria that can live and grow in the absence of oxygen), ureaplasma, and fungi uncommonly infect the upper urinary tract

## RISK FACTORS

- Condition that occurs during fetal development, in which the ureters (the tubes from the kidneys to the bladder) do not attach to the bladder properly or may attach to reproductive organs instead of the bladder (known as “ectopic ureters”); reflux of urine from the bladder back into the ureters (known as “vesicoureteral reflux”); congenital (present at birth) abnormal development of the kidneys (known as “renal dysplasia”); and lower urinary tract infection
- Conditions that increase the likelihood of urinary tract infection—such as diabetes mellitus (“sugar diabetes”); increased levels of steroids produced by the adrenal glands (known as “hyperadrenocorticism” or “Cushing's syndrome”); administration of medications containing steroids; kidney failure; catheterization of the urethra (the tube from the bladder to the outside, through which urine flows out of the body); urine retention; urinary tract stones (known as “uroliths”); urinary tract tumors; surgical removal of the penis with creation of a new opening into the urethra (known as “perineal urethrostomy”)
- In cats with lower urinary tract disease, indwelling urinary catheters combined with administration of steroids frequently results in bacterial infection/inflammation of the kidney (pyelonephritis)

## Treatment

### HEALTH CARE

- Outpatient, unless pet has generalized disease caused by the spread of bacteria in the blood (known as “septicemia” or “blood poisoning”) or has clinical signs of kidney failure

### ACTIVITY

- Unlimited

### DIET

- Modified kidney diet (Hill's Prescription Diet k/d for dogs or cats) recommended in pets with co-existent long-term (chronic) kidney failure or the presence of urinary tract stones in the kidney (known as “nephrolithiasis”)

### SURGERY

- Surgically correct abnormally located ureters (ectopic ureters); the “ureters” are the tubes from the kidneys to the bladder
- Complete blockage or obstruction of the upper urinary tract by a urinary tract stone (urolith) in a pet with bacterial infection/inflammation of the kidneys (pyelonephritis) may rapidly progress to generalized disease caused by the spread of bacteria in the blood (known as “septicemia” or “blood poisoning”), and should be regarded as a medical emergency; the cause of the blockage or obstruction of the urinary tract should be corrected by surgery or by a medical procedure in which the stone is broken up within the urinary tract using some type of energy or sound wave (procedures known as “lithotripsy”) for cases with kidney stones (known as “nephroliths”)
- Infected kidney stones (nephroliths)—surgically remove, medically dissolve (for struvite kidney stones), or fragment by extracorporeal shock wave lithotripsy a medical procedure in which the stone is broken up within the urinary tract using some type of energy or sound wave; use antibiotics at the time of the surgery or lithotripsy to reduce the risk of spreading bacterial infection from the urinary tract into the body (known as “urosepsis”) when manipulating infected kidney stones (nephroliths)

- Surgical removal of one kidney (known as “unilateral nephrectomy”) usually is not effective for elimination of suspected bacterial infection/inflammation involving only that kidney (known as “unilateral pyelonephritis”)

## Medications

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive

- Base antibiotic selection on bacterial culture and sensitivity testing of the urine
- Antibiotics should kill bacteria (known as “bactericidal antibiotics”), achieve good serum and urine concentrations, and not be toxic to the kidneys
- High serum and urinary antibiotic concentrations do not necessarily ensure high tissue concentrations in certain areas of the kidney (known as the “renal medulla”); thus, long-term (chronic) bacterial infection/inflammation of the kidney (pyelonephritis) may be difficult to eradicate
- Give antibiotics by mouth for 4–6 weeks, as instructed by your pet's veterinarian

## Follow-Up Care

### PATIENT MONITORING

- Perform urine cultures and urinalyses during antibiotic administration (approximately 5–7 days into treatment) and 1 and 4 weeks after antibiotics are finished

### PREVENTIONS AND AVOIDANCE

- Eliminate factors that increase the likelihood of urinary tract infection
- Surgically correct abnormally located ureters (ectopic ureters)

### POSSIBLE COMPLICATIONS

- Kidney failure; recurrent bacterial infection/inflammation of the kidney (pyelonephritis); struvite urinary tract stones in the kidneys (known as “struvite nephroliths”); generalized disease caused by the spread of bacteria in the blood (septicemia or blood poisoning); shock associated with generalized bacterial infection (known as “septic shock”); and spread of infection to other areas of the body, such as infection/inflammation of the heart (known as “endocarditis”) and infection/inflammation of several joints (known as “polyarthritis”)

### EXPECTED COURSE AND PROGNOSIS

- Pets with sudden (acute) bacterial infection/inflammation of the kidney (pyelonephritis)—fair to good, with a return to normal health unless the pet also has kidney stones (nephroliths), long-term (chronic) kidney failure, or some other underlying cause for urinary tract infection (such as urinary tract blockage or obstruction or cancer)
- Established long-term (chronic) infection of the renal medulla may be difficult to resolve because of poor tissue penetration of antibiotics to this area of the kidney
- Pets with long-term (chronic) kidney failure caused by bacterial infection/inflammation of the kidney (pyelonephritis)—prognosis determined by the severity and rate of progression of the chronic kidney failure
- Recurrent bacterial infection/inflammation of the kidney (pyelonephritis) is likely, if infected kidney stones (nephroliths) are not removed

## Key Points

- Recurrent bacterial infection/inflammation of the kidney (pyelonephritis) may not cause clinical signs
- Unresolved long-term (chronic) bacterial infection/inflammation of the kidney (pyelonephritis) may lead to long-term (chronic) kidney failure; diagnostic follow-up is important to document resolution or progression of pyelonephritis
- In pets with kidney stones (nephroliths), resolution of bacterial infection/inflammation of the kidney (pyelonephritis) is unlikely unless the kidney stones are removed