

# Calcium Oxalate Urolithiasis

## (Calcium Oxalate Stones in the Urinary Tract)

### Basics

#### OVERVIEW

- “Urolithiasis” is the medical term for the presence of stones (known as “uroliths”) in the urinary tract
- The most common minerals found in the stones (uroliths) are used to name the particular stone; in this type of stone, calcium and oxalate (or oxalic acid) make up the composition of the stone, and thus the name “calcium oxalate urolithiasis”
- Calcium oxalate urolithiasis is the formation of calcium oxalate stones (known as “calcium oxalate uroliths”) within the urinary tract and associated clinical conditions
- The urinary tract consists of the kidneys, the ureters (the tubes running from the kidneys to the bladder), the urinary bladder (that collects urine and stores it until the pet urinates), and the urethra (the tube from the bladder to the outside, through which urine flows out of the body)
- In dogs, calcium oxalate accounts for approximately 41% of the stones (uroliths) removed from the lower urinary tract (bladder and urethra) and 45% of those removed from the upper urinary tract (kidneys and ureters)
- In cats, calcium oxalate accounts for approximately 40% of the stones (uroliths) removed from the lower urinary tract (bladder and urethra) and 70% of those retrieved from the upper urinary tract (kidneys and ureters)



#### SIGNALMENT/DESCRIPTION OF PET

##### Species

- Dogs
- Cats

##### Breed Predilections

- Dogs—reported in many breeds—six breeds represent 60% of cases: miniature schnauzer, Lhasa apso, Yorkshire terrier, bichon frise, shih tzu, and miniature poodle
- Cats—Himalayan, Scottish fold, Persian, ragdoll, and Burmese are at greater risk of forming calcium oxalate stones than other breeds

##### Mean Age and Range

- Dogs—8.5 years of age; 60% of cases are 6–11 years of age

- Cats—97% are older than 2 years of age; 53% of cases are 7–15 years of age

### **Predominant Sex**

- Mostly male dogs (73%) and male cats (55%)

## **SIGNS/OBSERVED CHANGES IN THE PET**

- Some pets have no signs of disease (known as “asymptomatic”)
- Depend on location, size, and number of urinary tract stones (uroliths)
- Pets with stones located in the kidney(s) (known as “nephroliths”) are typically asymptomatic, but may have persistent blood in the urine (known as “hematuria”)
- The blockage or obstruction of a ureter (the tube running from the kidney to the bladder) is associated with changes in the kidneys, and sudden (acute) excess levels of urea and other nitrogenous waste products in the blood (known as “uremia” or “azotemia”) and occur frequently in cats with long-term (chronic) kidney failure
- Typical signs of stones in the bladder (known as “urocystoliths”) or the urethra (the tube from the bladder to the outside, through which urine flows out of the body; stones known as “urethroliths”) include abnormal frequent passage of urine (known as “pollakiuria”); difficulty urinating (known as “dysuria”) and blood in the urine (hematuria)
- Stones in the kidneys and ureters (the tubes running from the kidneys to the bladder; stones known as “nephroureteroliths”) are common in cats with long-term (chronic) kidney failure
- Stones in the bladder (urocystoliths) may be detected during physical examination; failure to feel stones does not exclude them from consideration.
- Enlarged urinary bladder, if the pet has complete blockage or obstruction of the urethra (the tube from the bladder to the outside, through which urine flows out of the body)—more common in cats
- Stones in the bladder (urocystoliths) with irregular contours uncommonly cause complete blockage or obstruction of the urethra (the tube from the bladder to the outside, through which urine flows out of the body)

## **CAUSES**

- Presence of high levels of calcium in the urine (known as “hypercalciuria”); high levels of oxalic acid or oxalates in the urine (known as “hyperoxaluria”); low levels of citrate in the urine (known as “hypocitraturia”); and defective crystal-growth inhibitors (substances that increase the solubility of calcium oxalate and decrease the likelihood of stone formation)
- Feeding diets that promote acidic urine (known as “aciduria”) in cats

## **RISK FACTORS**

- Calcium supplements given independent of meals
- Excessive dietary protein and vitamin D may increase the amount of calcium in the urine, leading to high levels of calcium in the urine (hypercalciuria)
- Additional dietary oxalate (such as from peanuts) and ascorbic acid may increase the amount of oxalic acid and oxalates in the urine, leading to hyperoxaluria
- High levels of steroids (either occurring naturally in the body, when the adrenal glands produce excess steroids, or by administration of steroid-containing medications), diets that promote formation of acidic urine (aciduria), and furosemide (a diuretic) may increase the amount of calcium in the urine, leading to high levels of calcium in the urine (hypercalciuria)
- Pyridoxine (vitamin B6)-deficient diets (such as homemade diets) may increase the amount of oxalic acid and oxalates in the urine, leading to high levels of oxalic acid or oxalates in the urine (hyperoxaluria)
- Consumption of dry diets is associated with a higher risk for calcium oxalate stone (urolith) formation than consumption of high-moisture, canned diets

# **Treatment**

## **HEALTH CARE**

- Removal of the stones can be performed by flushing stones located in the urethra (the tube from the bladder to the outside, through which urine flows out of the body) back into the urinary bladder or by positioning the pet and using gentle compression of the bladder to allow the pet to urinate and “pass” the stones to eliminate small bladder stones on an outpatient basis; allowing the pet to urinate and “pass” the stones should not be tried if

blockage or obstruction of the urethra exists

- Medical procedures in which the stone is broken up within the urinary tract using some type of energy or sound wave (procedures known as “laser lithotripsy” or “shock-wave lithotripsy”) and surgery require short periods of hospitalization

## ACTIVITY

- Reduce activity following surgery, until healed

## DIET

- Calcium oxalate stones (uroliths) do not dissolve well with special diets but some are helpful
- Increased levels of calcium in the blood (known as “hypercalcemia”) in cats (without evidence of increased levels of parathyroid hormone and its effects [known as “hyperparathyroidism”] or cancer) is sometimes minimized by use of Hill's Prescription Diet Feline w/d, c/d; Royal Canin s/o

## SURGERY

- Consider surgical removal of lower urinary tract stones (uroliths) that cannot be removed by other means
- Shock-wave lithotripsy (in which the stone is broken up within the urinary tract using some type of energy or sound wave) is an alternative to surgery for removal of kidney stones (nephroliths), ureter stones (ureteroliths), and bladder stones (cystoliths) in dogs
- Consider surgical removal of the parathyroid glands (known as “parathyroidectomy”) for pets with primary hyperparathyroidism and increased levels of calcium in the blood (hypercalcemia)

## Medications

- No available drugs effectively dissolve calcium oxalate stones (uroliths)

## Follow-Up Care

### PATIENT MONITORING

- Post-surgical x-rays (radiographs) are essential to verify complete stone (urolith) removal
- To attempt to prevent the need for repeated surgery, evaluate abdominal x-rays (radiographs) every 3–5 months to detect stone (urolith) recurrence early (small stones may be removed by flushing stones located in the urethra [the tube from the bladder to the outside, through which urine flows out of the body] back into the urinary bladder or by positioning the pet and using gentle compression of the bladder to allow the pet to urinate and “pass” the stones)

### PREVENTIONS AND AVOIDANCE

- If the pet has high levels of calcium in the blood (hypercalcemia), correct underlying cause
- Consider Prescription Diets for cats with increased levels of calcium in their urine for unknown cause (condition known as “idiopathic hypercalciuria”); administer potassium citrate to minimize acidic urine (aciduria)
- If the pet has normal levels of calcium in the blood (known as “normocalcemia”), consider a diet with reduced oxalate and protein that does not promote formation of acidic urine (such as Hill's Prescription Diet Canine u/d); ideally, the diet should contain additional water (canned diets) and citrate, and have adequate quantities of phosphorus and magnesium; avoid supplementation with vitamins C and D
- Reevaluate pet 2–4 weeks after initiation of diet therapy to verify appropriate reduction in specific gravity of the urine (indicating a more dilute or less concentrated urine, which makes it more difficult for crystals to form), appropriate urine pH of 6.5 or higher (indicating that the urine is not in the acidic range), and decrease in crystals in the urine (known as “crystalluria”)
- To promote more dilute or less concentrated urine, consider feeding canned formulations of food or add water to all types of food
- If urine is acidic, consider adding potassium citrate; adjust dosage to achieve a urine pH between 6.5 and 7.5
- Vitamin B6 may help minimize oxalate excretion into the urine, especially for pets fed homemade or pyridoxine (vitamin B6)-deficient diets

### POSSIBLE COMPLICATIONS

- Stones in the bladder (urocystoliths) can pass into and block the urethra (the tube from the bladder to the

outside, through which urine flows out of the body) in male dogs and cats, especially if the pet is having difficulty urinating (dysuria)

- Dogs that do not consume their daily requirement of the stone (urolith) prevention diet may develop various degrees of protein-calorie malnutrition
- Diet-associated increased levels of lipids (a group of compounds that contain fats or oils, condition known as “hyperlipidemia”) develops in some pets; miniature schnauzers with inherited hyperlipidemia are more likely to develop inflammation of the pancreas (known as “pancreatitis”) when consuming the stone-prevention diet; Hill's Prescription Diet Canine w/d can be used as an alternative diet (it should be supplemented with potassium citrate, as needed, to maintain a urine pH between 6.5 and 7.5)

## **EXPECTED COURSE AND PROGNOSIS**

- Approximately 50% of dogs with normal calcium levels in their blood (normocalcemia) reform calcium oxalate stones (uroliths) in 2 years; pets with persistently increased levels of calcium in their blood (hypercalcemia) typically reform calcium oxalate stones at a faster rate
- Treatment to minimize recurrence of calcium oxalate stones (uroliths) is helpful
- At least 10% of cats reform calcium oxalate stones (uroliths) in 2 years

## **Key Points**

- Stone (urolith) removal does not alter the factors responsible for their formation; eliminating or minimizing risk factors is necessary to minimize recurrence
- Approximately 50% of dogs with normal calcium levels in their blood (normocalcemia) reform calcium oxalate stones (uroliths) in 2 years; pets with increased levels of calcium in their blood (hypercalcemia) typically reform calcium oxalate stones at a faster rate
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- At least 10% of cats reform calcium oxalate stones (uroliths) in 2 years