

# Urolithiasis

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Urinary stone management can be a confusing topic to handle due to the various types of stones that form and the different ways they are managed. However, focusing on a handful of key facts can give you the knowledge to deal with most of the likely scenarios you will see on a board exam by emphasizing the common stone types. For this review, canine and feline struvite and calcium oxalate stones are discussed together with key differences pointed out. Stone management strategies for cystine and urate stones apply to dogs only as urate and cystine stones are rare in cats.

## Key Points

- **Most common type:** Dogs and cats - struvite and calcium oxalate
- Medical dissolution is possible for most stones except **calcium oxalate**
- Use an **alkalinizing diet** for treatment of **cystine and urate** stones. **Acidify** for **struvite**
- The radiolucent stones are **cystine and urate**, they may not be visible on a radiograph
- **Reduced protein diet** for management of **cystine, urate, canine struvite and to a lesser degree, calcium oxalate stones**

## General Management (For All Stone Types):

- Increase urine volume (to keep urine dilute) into which crystal forming substrates are dissolved. This is usually done with a **high moisture content food**
- Reduce the quantities of crystal forming substrates in the urine (specifics depend on stone type)
- Increase the urine solubility of crystal forming substrates (often by affecting pH)

## Struvite Stones (Magnesium Ammonium Phosphate)

### Dietary Management:

In dogs, struvite stones are usually induced by urinary tract infections (UTI) by urease positive microbes. The goal of treatment is to decrease the three components of the crystals:

- Magnesium - Low magnesium diet
- Ammonium - High quality, reduced protein diet to reduce urine urea concentration which will be converted to ammonia by microbial urease. This is not important in most cats which have sterile struvite stones.
- Phosphate - Low phosphorous diet



Additionally, because dog struvite stones are usually associated with infection, treat with appropriate antimicrobials based on culture and sensitivity, ideally ones that are excreted at high levels in the urine.

## Calcium Oxalate

The most difficult and unlikely to dissolve. Likely require surgery, voiding hydropulsion, or lithotripsy.

Predisposed breeds: Schnauzer, Lhasa apso, Yorkshire terrier, Bichon Frise, Shih Tzu, Miniature Poodle

### Dietary Management:

- **Avoid** excessive protein, calcium, oxalate, vitamin D and sodium
- **Provide** adequate phosphorous (to prevent Vitamin D activation), magnesium, and Vitamin B6
- Calcium oxalate crystals and stones are more likely to occur in acidic urine. While an alkalinizing diet is unlikely to dissolve stones, it may be recommended to prevent new stones from forming.

## Cystine

Predisposed breeds: Bulldogs, Newfoundlands, Dachshunds, Basset Hounds, Chihuahuas, Yorkshire Terriers

### Dietary Management:

- Reduced protein, sodium restricted, urine alkalinizing diet
- Urine alkalinizer (potassium citrate (preferred), or oral sodium bicarbonate)
- **2-MPG**- 2 mercaptopropionyl-glycine (Thiola) – binds to cystine to form a more soluble compound

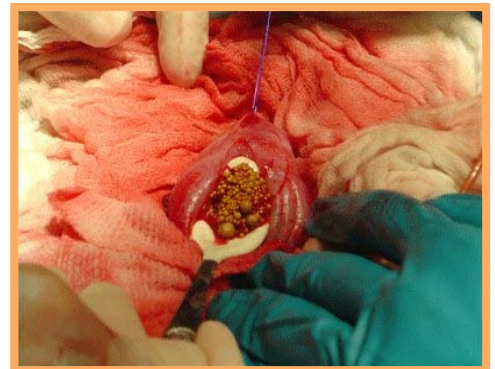
## Urate

Predisposed breed: Dalmatians

### Dietary Management:

- Reduced protein, urine alkalinizing diet
- **Urine alkalinizer** (potassium citrate (preferred), or oral sodium bicarbonate)
- **Allopurinol** - Decreases uric acid by inhibition of conversion of hypoxanthine → xanthine → uric acid.

CAUTION: Giving allopurinol without a reduced protein diet may lead to formation of xanthine stones or create a xanthine shell around a preexisting urate stone.



## Other stone types

Rare types of stones seen in dogs and cats include calcium phosphate, xanthine, and silica.

## References and Links

Ettinger, Feldman, Textbook of Veterinary Internal Medicine, 5th ed. pp. 1753-1778- This is a lot more than you need to know but there are some handy tables and flowcharts.

### VIN links:

Uroliths I and II

<http://www.vin.com/Members/Proceedings/Proceedings.plx?CID=tufts2002&PID=pr02063&O=VIN>

Nutrition in Lower Urinary Tract Disorders

[www.vin.com/Members/Proceedings/Proceedings.plx?CID=acvim2003&PID=pr03864&O=VIN](http://www.vin.com/Members/Proceedings/Proceedings.plx?CID=acvim2003&PID=pr03864&O=VIN)

