Managing Crystalluria and Urolithiasis

Feline

RECOMMENDED BY VETERINARIANS WORLDWIDE

Feline
General Points

Crystal identification

- Perform microscopic examination of sediment from a fresh urine preferably less than 30min after collection sample at room temperature
- Recognise the main crystal types (shown) but don't attempt to identify everything on the slide
- Background colours are due solely to the addition of a stain, to show crystals more clearly
- The most common crystals are of struvite or calcium oxalate
- At times crystals of more than one type of mineral can be present
- Crystals of some minerals (principally struvite and calcium oxalate monohydrate) can vary considerably in size and shape
- Crystalluria represents a risk factor but not an evidence for urolithiasis

Urolith appearance

- Only quantitative analysis can reliably determine the composition
- Prolonged exposure to blood pigment (in the bladder) will darken the surface
- Changes in the urine during formation of a urolith can result in it having a central nidus or an outer shell (sometimes both) of a different composition to the rest of the stone

At risk profile

- Lists factors predisposing to this type of mineral-associated FLUTD

Initial management

- Lists priority procedures for relief of clinical signs

Long term management

- Details nutritional requirements to reduce the risk of occurrence and recurrence in high risk cats
- Always stimulate water intake in patients with crystalluria and/or uroliths

Feline Idiopathic Cystitis (FIC)

- FIC is diagnosed when a underlying cause for the clinical signs of FLUTD cannot be identified after a proper evaluation. Stress is believed to play an important role in triggering and/or exacerbating FIC.

Other diseases

- Some uroliths (e.g., ammonium urate and calcium phosphate) may be the result of other diseases, hence a thorough diagnostic work-up is advised in all cases

Your Partner

Hill's is here to help you to help your patient

Free urolith analysis and interpretation

www.hillspet.co.za/urinary-health
website full of support information for your patients

Complete range for all your feline urinary cases

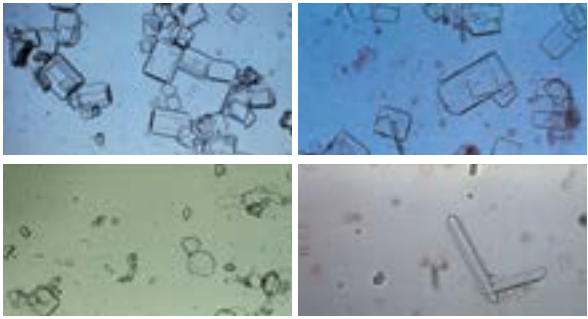
c/d™ Multicare Chicken

c/d™ Multicare with Ocean Fish

c/d™ Multicare Reduced Calorie

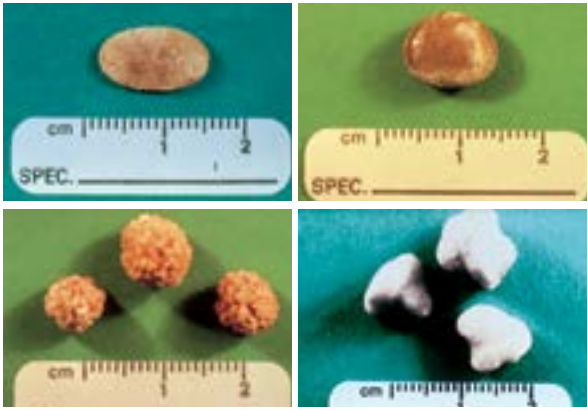
c/d™ Urinary Stress

Feline
Struvite magnesium ammonium phosphate



Crystal identification

- Characteristically colourless, coffin-lid shaped rectangular crystals (upper row), shorter than in the dog and often with some square forms (that might be confused with calcium oxalate mono- or dihydrate)
- Rarely crystals aggregate on the slide into fern-like structures
- Less typical forms (lower row) include hexagonal & octagonal forms (which might be mistaken for cystine) and narrow, pointed crystals. Struvite will dissolve in dilute acetic acid, but cystine won't



Urolith identification

- Very common type of urolith in cats. If sterile (>90% of cases) usually appears as an oval wafer or disc (top left), occasionally as a jagged, quartz-like structure. If infected is often egg-shaped (top right). May have surface irregularities (lower left). Lower right shows infection-induced uroliths with 10% calcium phosphate
- Usually creamy or light brown colour (darkens with prolonged exposure to blood pigment)
- Most uroliths occur in the bladder
- Radiopaque

Feline
Struvite magnesium ammonium phosphate

At risk profile

- Cats between 2 and 10 years old
- Overweight/obese
- Low water intake
- Less acidic to alkaline urine (> pH 6.5)
- Sometimes urinary tract infection with urease-producing bacteria, particularly staphylococci
- Indoor lifestyle
- Multiple cat household
- Urethral Plugs: Struvite is the principal mineral in urethral plugs, which occur almost solely in males – particularly neutered

Initial management

Urethral plugs: empty bladder and restore urethral patency

c/d™ products - rapid and safe dissolution

- Nutrition clinically proven to dissolve struvite stones in as little as 14 days.

Initial patient work up to determine underlying cause. Depending on body condition score (BCS), feed:

Normal weight cats (BCS = 3/5)	Normal weight cats (BCS = 3/5) when stress can be excluded	Overweight or obese-prone cats (BCS ≥ 3.5/5)
c/d™ Urinary Stress	c/d™ Multicare	c/d™ Multicare Reduced Calorie

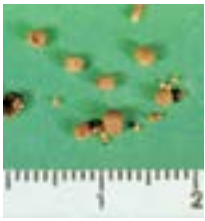
After diagnosis and for reduction of recurrence

	Large or multiple struvite stones	
c/d™ Urinary Stress	s/d™	c/d™ Multicare Reduced Calorie
FLUTD with stress	c/d™ Multicare	for cats with BCS ≥ 3.5/5

Feline
Calcium oxalate monohydrate

Crystal identification

- Vary in size and shape, usually dumbbell (top left) or oval (top right), rarely rectangular with rounded ends (lower left) or spindle-shaped
- Colourless
  (All illustrations also include calcium oxalate dihydrate crystals)



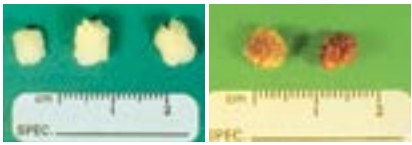
Urolith identification

- Very common type of urolith in cats
- Characteristically small, smooth and spherical, though may be irregular
- Usually tan or brown colour
- Radiopaque
- Renal uroliths very likely to be oxalate

Calcium oxalate dihydrate

Crystal identification

- Vary in size, but always octahedral in shape
- Colourless
- Appear as ‘envelopes’, i.e. square with prominent diagonals (which distinguish from struvite crystals)



Urolith identification

- Characteristic irregular ‘crystalline’ appearance (left) or with irregular surface (right). Mixtures of dihydrate and monohydrate often occur (urolith above right is 60% dihydrate, 35% monohydrate)
- Usually white or creamy colour
- Radiopaque

Feline
Calcium oxalate monohydrate/dihydrate

At risk profile

- Cats between 4 and 15 years of age
- Overweight/obese
- Low water intake
- Indoor lifestyle
- Single cat household
- Persian, Burmese, Himalayan

Initial patient work up to determine underlying cause. Depending on body condition score (BCS), feed:

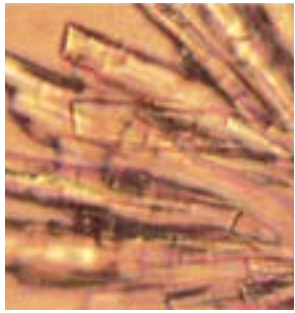
Normal weight cats (BCS = 3/5)	Normal weight cats (BCS = 3/5) when stress can be excluded	Overweight or obese-prone cats (BCS ≥ 3.5/5)
c/d™ Urinary Stress	c/d™ Multicare	c/d™ Multicare Reduced Calorie

Calcium oxalate crystals and/or uroliths

Surgery to remove oxalate uroliths

c/d™ Urinary Stress	c/d™ Multicare	c/d™ Multicare Reduced Calorie
FLUTD with stress		for cats with BCS ≥ 3.5/5

Feline
Calcium phosphate



Crystal identification

- Mostly seen as amorphous phosphates, i.e. 'shapeless' appearing as a mass of tiny spheres, and often associated with struvite crystals, as above left
- Exception is brushite, appearing as long, thin 'needles', often aggregated (enlarged, right)

Urolith identification

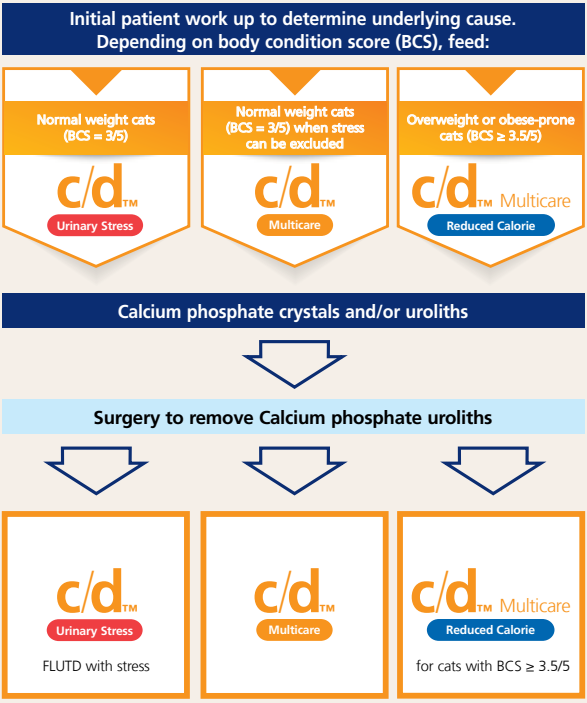
- Uroliths of pure calcium phosphate are rare, resembling struvite; usually it occurs as a minor component of other uroliths, especially struvite
- Radiopaque

PRESCRIPTION DIET

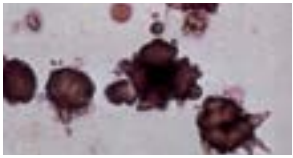
Feline
Calcium phosphate

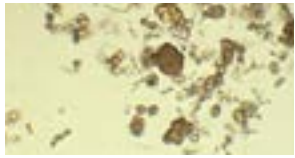
At risk profile

- Typically less acidic urine, except brushite which forms in more acidic urine



Feline
Ammonium urate





Crystal identification

- Ammonium urate (ammonium acid urate, ammonium biurate) crystals are dark and roughly spherical with irregular projections – termed 'thorn-apple' crystals and which resemble mange mites (top left)
- Urate salts of sodium, potassium, magnesium or calcium appear amorphous (top right), like calcium phosphate. However, on centrifugation a sediment of amorphous phosphates appears white in the tube and amorphous urates appears tan in colour. Adding 10% acetic acid dissolves amorphous phosphates but not amorphous urates though it often results in uric acid crystals (enlarged, lower right)
- Naturally-occurring uric acid crystals are rare

Urolith identification

- Characteristically smooth surface with concentric layers of mineral, the outer layers may break off
- Radiolucent or poorly radiopaque

Feline
Ammonium urate

At risk profile

- Low water intake
- Typically ammonium urate forms in acid to neutral urine
- High purine diets
- Cats with portal vascular anomalies (=portosystemic shunt=PSS)

Ammonium urate

In PSS, treat PSS or uroliths first, based on main clinical situation

Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

k/d™

Complete range of dry and wet products

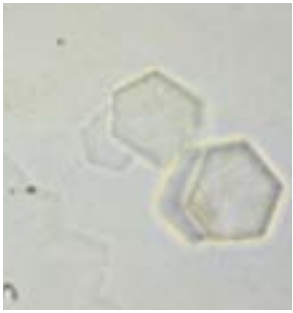
Dry

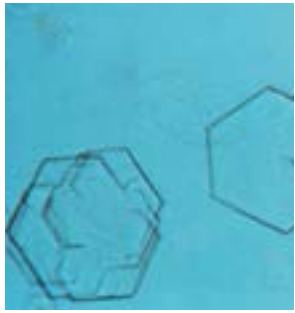
Pouches

with Chicken

Can

Feline
Cystine





Crystal identification

- Colourless, hexagonal crystals with equal or unequal sides; may overlap or aggregate

Urolith identification

- Smooth, small, round to oval
- Poorly radiopaque

Feline
Cystine

At risk profile

- Low water intake
- More acidic urine

Cystine

Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

k/d™

Complete range of dry and wet products

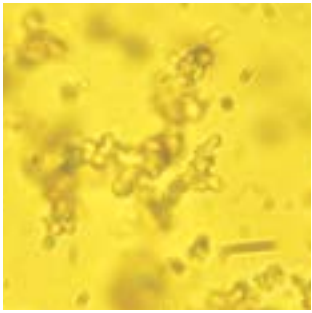
Dry

Pouches

with Chicken

Can

Feline
Xanthine



Crystal identification

- Spherical yellow/brown crystals, resembling amorphous urates or phosphates

Urolith identification

- Resemble urate uroliths but yellow/brown
- Radiolucent or poorly radiopaque

Feline
Xanthine

At risk profile

- Low water intake
- Cats receiving allopurinol

Xanthine

Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

k/d™

Complete range of dry and wet products

Dry

Pouches

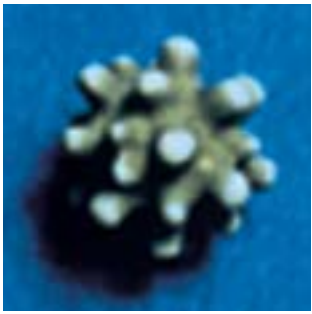
with Chicken

Can

Feline
Silica

Crystal identification

- Too small to be visible by light microscopy



Urolith identification

- Typically jackstone appearance
- Radiopaque

Feline
Silica

At risk profile

- Low water intake
- Eating soil (pica)

Silica

Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

k/d™

Complete range of dry and wet products

Dry

Pouches

with Chicken

Can

Feline
General

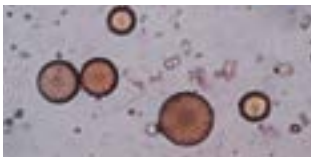
Other crystals that may rarely be seen

Bilirubin

Cholesterol

Sulpha drugs

Tyrosine



Calcium carbonate
(usually herbivores only, e.g. rabbits)

Beware of artefacts, e.g. this is a chip on the microscope slide

Hill's PRESCRIPTION DIET

Managing Crystalluria and Urolithiasis

Canine

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Canine
General Points

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- Recognise the main crystal types (shown) but don't attempt to identify everything on the slide
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- Only quantitative analysis can reliably determine the composition
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- Changes in the urine during formation of a urolith can result in it having a central nidus or an outer shell (sometimes both) of a different composition to the rest of the stone

At risk profile

- Lists factors predisposing to this type of crystalluria and urolithiasis

Initial management

- Lists priority procedures for relief of clinical signs

Long term management

- Details nutritional requirements for prevention of occurrence and recurrence in high risk dogs
- Always stimulate water intake in patients with crystalluria and/or uroliths

Other diseases

- Some uroliths (e.g., ammonium urate and calcium phosphate) may be the result of other diseases, hence a thorough diagnostic work-up is advised in all cases

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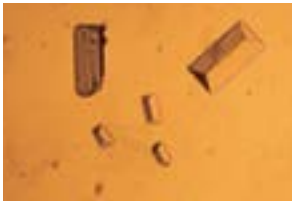
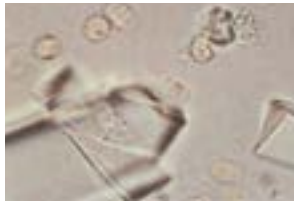
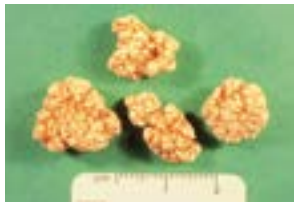
PRESCRIPTION DIET

Canine
Struvite magnesium ammonium phosphate

Crystal identification

- Characteristically colourless, coffin-lid shaped rectangular crystals, of varying sizes
- Rarely crystals aggregate on the slide into fern-like structures


Urolith identification

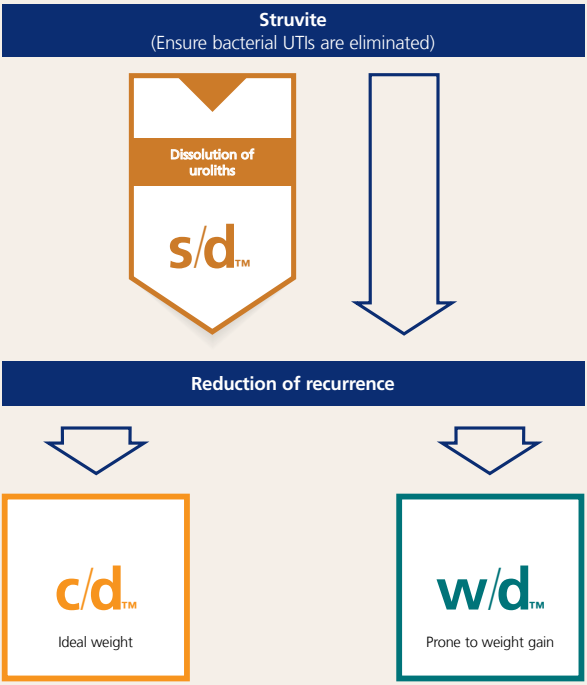
- Most common type of urolith in bitches
- Characteristically multiple, round or faceted with a smooth surface and creamy to grey in colour (top left). May have irregular surface (top right)
- Often contains a proportion of calcium phosphate (e.g. urolith lower left is 80% struvite, 20% calcium phosphate)
- Radiopaque

PRESCRIPTION DIET

Canine
Struvite magnesium ammonium phosphate

At risk profile

- Bitches
- Puppies
- Low water intake
- Usually urinary tract infection with urease-producing bacteria, particularly staphylococci
- Miniature schnauzer, shih-tzu, bichon frise
- High protein diets
- Less acidic urine



Canine
Calcium oxalate monohydrate

Crystal identification

- Vary in size and shape; typically 'oval' (top left, underneath calcium oxalate dihydrate crystal, and top right, enlarged)
- Sometimes long and pointed (lower left), sometimes dumbbell-shaped
- Colourless

Urolith identification

- Most common type of urolith in male dogs
- Often round and smooth (top left). Sometimes darkened by blood pigment (top right), rarely have 'jackstone' appearance (lower left)
- Radiopaque

PRESCRIPTION DIET

Canine
Calcium oxalate monohydrate

At risk profile

- Males
- Low water intake
- Miniature schnauzer, Lhasa apso, Yorkshire terrier
- High animal protein diets
- More acidic urine

Initial management

- Surgically remove any uroliths

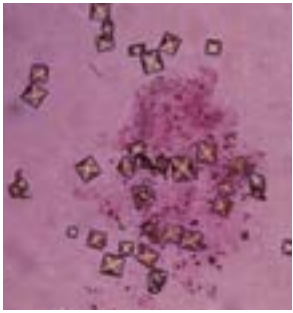
Calcium oxalate
monohydrate

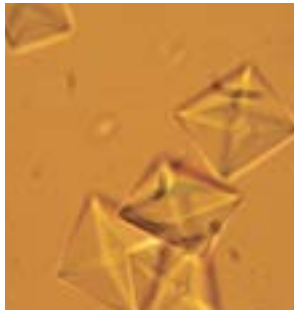
Surgically remove any uroliths, monitor and treat UTI

Reduction of reccurence

u/d™

Canine
Calcium oxalate dihydrate





Crystal identification

- Vary in size, but always octahedral in shape. Colourless. Appear as 'envelopes', i.e. square with prominent diagonals

Urolith identification

- Usually have rough, irregular surface. Urolith on left shows adherent blood clot
- Radiopaque

PRESCRIPTION DIET

Canine
Calcium oxalate dihydrate

At risk profile

- Males
- Low water intake
- Miniature schnauzer, Lhasa apso, Yorkshire terrier
- High animal protein diets
- More acidic urine

Initial management

- Surgically remove any uroliths

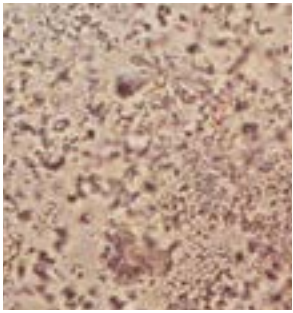
Calcium oxalate
dihydrate

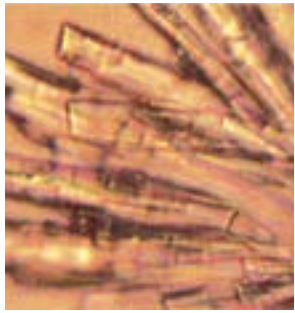
Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

u/d™

Canine
Calcium phosphate





Crystal identification

- Mostly seen as amorphous phosphates, i.e. ‘shapeless’ appearing as a mass of tiny spheres (left)
- Exception is brushite, appearing as long, thin, ‘needles’, often aggregated (enlarged, right)

Urolith identification

- Uroliths of pure calcium phosphate are unusual, resembling struvite; usually it occurs as a minor component of other uroliths, especially struvite
- Radiopaque

PRESCRIPTION DIET

Canine
Calcium phosphate

At risk profile

- Typically less acidic urine, except brushite which forms in more acidic urine

Calcium phosphate alone

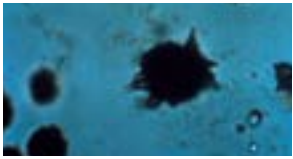
Surgically remove any uroliths, monitor and treat UTI

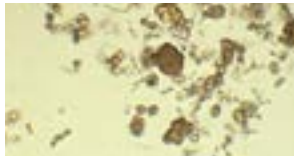
Reduction of recurrence

c/d™
Ideal weight

w/d™
Prone to weight gain

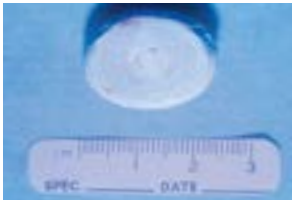
Canine
Ammonium urate





Crystal identification

- Ammonium urate (ammonium acid urate, ammonium biurate) crystals are dark and roughly spherical with irregular projections – termed 'thorn-apple' crystals and which resemble mange mites (top left)
- Urate salts of sodium, potassium, magnesium or calcium appear amorphous (top right), like calcium phosphate. However, on centrifugation a sediment of amorphous phosphates appears white in the tube and amorphous urates appears tan in colour. Adding 10% acetic acid dissolves amorphous phosphates but not amorphous urates though it often results in uric acid crystals (enlarged, lower right)
- Naturally-occurring uric acid crystals are rare



Urolith identification

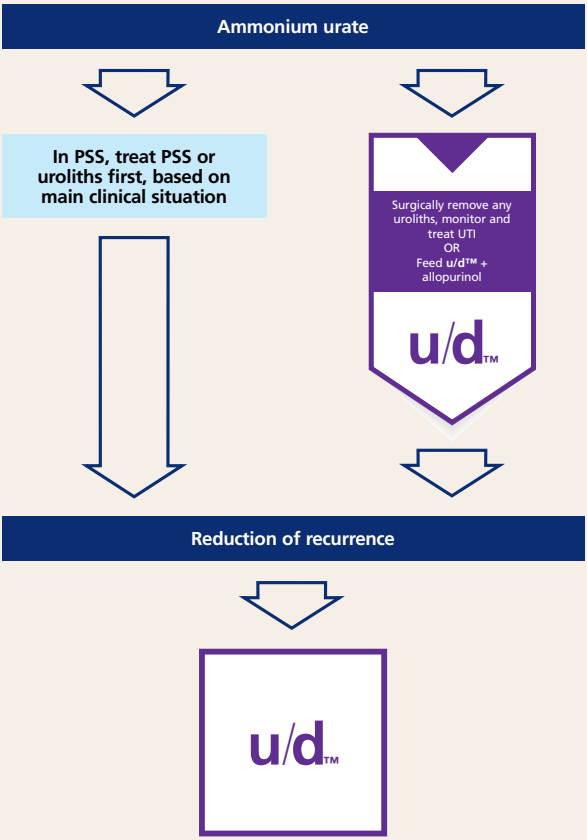
- Characteristically smooth surface with concentric layers of mineral. The urolith on the left has been cut to show the layers ('onion skin'). Outer layers may break off
- Radiolucent or poorly radiopaque

PRESCRIPTION DIET

Canine
Ammonium urate

At risk profile

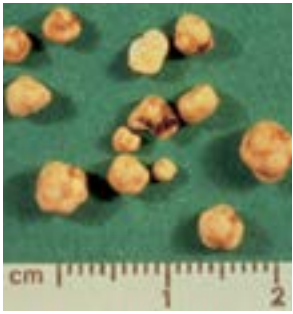
- Males
- Low water intake
- Dalmatians (defective uric acid metabolism)
- Breeds prone to portal vascular anomalies (Portosystemic shunt = PSS)
- Typically ammonium urate forms in acid to neutral urine



Canine
Cystine

Crystal identification

- Colourless, hexagonal crystals with equal or unequal sides; may overlap or aggregate



Urolith identification

- Usually smooth and spherical, may be multiple
- Poorly radiopaque

PRESCRIPTION DIET

Canine
Cystine

At risk profile

- Males
- Bulldog, Dachshund, Newfoundland
- Low water intake
- More acidic urine

Cystine
Ensure bacterial UTIs are eliminated

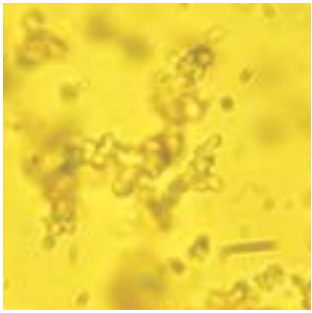
Dissolution of uroliths
Feed **u/d™** + tiopronin

u/d™

Reduction of recurrence

u/d™

Canine
Xanthine



Crystal identification

- Spherical yellow/brown crystals, resembling amorphous urates or phosphates

Urolith identification

- Resemble urate uroliths but yellow/brown
- Radiolucent or poorly radiopaque

Canine
Xanthine

At risk profile

- Males
- Dogs receiving allopurinol, especially Dalmatians
- Low water intake

Xanthine

Surgically remove any uroliths, monitor and treat UTI

Reduction of recurrence

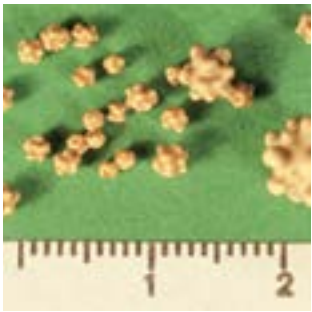
u/d™

reduce
the allopurinol dose
where appropriate
for successful
treatment

Canine
Silica

Crystal identification

- Too small to be visible by light microscopy



Urolith identification

- Typically jackstone appearance
- Radiopaque

PRESCRIPTION DIET

Canine
Silica

At risk profile

- Males
- Low water intake
- German shepherd, Golden retriever
- Low quality cereal foods
- Eating soil (pica)

Silica

Surgically remove any uroliths, monitor and treat UTI

Reduction of reccurence

u/d™

Canine
General

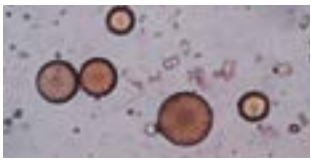
Other crystals that may rarely be seen

Bilirubin

Cholesterol

Sulpha drugs

Tyrosine



Calcium carbonate
(usually herbivores only, e.g. rabbits)

Beware of artefacts, e.g. this is a chip on the microscope slide