If I could have the reader of this webpage take away just one word from this discussion, it would be "water". If your cat is on a properly hydrated diet of 100% canned food - and no dry food - you stand a very good chance of never needing to read this webpage.

Always keep in mind that water flowing through the urinary tract system is the most important factor in keeping it healthy.

Note that I said "water" - not "crystals" or "urine pH" - or any of the expensive prescription diets often recommended by veterinarians.

A cat's normal prey is ~70% water. Canned food is ~78% water. Dry food is ~5-10% water. Cats have a low thirst drive and do not make up the deficit at the water bowl. They are designed to get water with their food.

Cats on canned food have been shown to consume at least double the amount of water (from food and water bowl) when compared to a dry food-fed cat.

This results in approximately double the amount of urine flowing through the bladder.

Think of canned food as not only a proper diet for an obligate carnivore, in general (see Feeding Your Cat: Know the Basics of Feline Nutrition), but also understand that it is the healthiest way to keep your cat's bladder flushed out and 'happy'.

If you do not want to read this entire webpage, please at least scroll down to see Opie's pictures. Opie is a very sweet, (previously dry food-fed) cat that suffered tremendously when his urethra became blocked in July 2008. He has been fine since his blockage and will always be maintained on canned food.

It makes absolutely no sense to feed dry food to any cat - especially one with urinary tract problems.

If your cat is a 'dry food addict', please see Tips for Transitioning Dry Food Addicts to Canned Food. All cats can be switched to canned food if the caregiver is patient enough.

Please note that when you change your cat's diet to canned food, the litter box will need to be cleaned more frequently.

It is also very important to make sure that you have enough large litter boxes with CLEAN clumping (scoopable) litter placed in easily accessible locations in your home so that your cat will not 'hold his/her urine' for any reason.

Litter boxes should always be scooped at least twice daily.

See The Litter Box From Your Cat's Point of View. This webpage discusses the importance of providing clean litter boxes with an inviting litter.

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**Lower urinary tract clinical signs**

- Cystitis
- Urethral obstruction/Opie's story
- Urinary tract infection
- Urinalysis/Dietary issues

**Prescription diets**

Patients may exhibit one or more more of these signs:

- Straining to urinate - with and without production of urine
- Frequent trips to the litter box - with and without production of urine
- Crying while urinating
- Excessive licking of the genital area
- Blood in the urine
- Urinating in places other than in the litter box
- Posturing (squating) in the litter box for a long period of time  (Note that sometimes people think that their cat is constipated when he/she is really showing signs of a lower urinary tract problem.)

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**Cystitis**

Cystitis, also known as Interstitial Cystitis, refers to inflammation of the bladder wall leading to painful, frequent voiding of small amounts of urine. This is one reason why clumping (scoopable) litters should be used. Scoopable litters will enable the feline caregiver to keep track of the size of the urine clumps to determine if the cat is urinating more frequently than usual.

Cats with cystitis will often have many small urine balls in the litter box. If the cystitis is severe enough, there will be blood in the urine but this blood is not readily apparent once the urine is voided into the litter.

**Important: The presence of blood in the urine does *not* necessarily mean that an infection is present.**

Cystitis can be a very painful condition! The patient will often start to associate the litter box with his/her pain. This can lead to litter box aversion which causes the
patient to urinate elsewhere. In these cases, there may be fewer urine balls in the litter box than usual.

**Important:** These cats need pain medication such as buprenorphine (Buprinex).

What causes cystitis? I wish that the veterinary community knew the answer to that question in all cases.

What we do know is that cystitis often appears to be linked to stress and the highly concentrated urine that results from being fed a water-depleted (dry food) diet may also be a significant factor in some cats. The concentration of urine is reflected by the urine specific gravity (USG) number found on the urinalysis report. The higher the number, the more concentrated the urine. (See the Urinalysis/Dietary Issues section below for information regarding how to measure your cat’s USG at home.)

We know that bladders are ‘happier’ with more water flowing through them which helps to flush out debris (mucus, cells, crystals) and keep the urine diluted. Dilute urine is thought to be less irritating to the bladder wall. Therefore, we see far more cases of cystitis in dry food-fed cats than in cats eating canned food.

We also know that 99% of cystitis cases in otherwise-healthy patients are *not* due to a bladder infection - contrary to popular belief. The erroneous belief that cystitis is always secondary to an infection leads to the rampant abuse of antibiotics.

It is very troubling to witness the very common practice of ‘shotgun’ treating these patients with antibiotics when most of these cases are *sterile* (sterile = no infection) cystitis.

It is also very frustrating to see these poor cats leaving the veterinary clinic with no pain medication!

To repeat: We know that stress plays an important role in the cause of cystitis. Can you think of anything more stressful than pain?

See the vicious cycle? Stress can cause cystitis. Cystitis is painful. Pain is very stressful.

**Crystals** are not thought to be a significant cause of cystitis. This is another very common misconception among both lay people and veterinarians leading to, in many cases, inappropriate usage of acidicifying prescription diets which can potentially lead to calcium oxylate stones and exacerbate the bladder inflammation.

That said, dietary management must be considered on a case-by-case basis and one-size-fits-all recommendations with respect to diet composition cannot be given. That said, I will give one ‘one-size-DOES-fit-all’ statement and that is “canned food is always better than dry food due to the appropriate water content in canned foods.”

Bladder stones (aka “cystolith” or “cystoliths”) may or may not contribute to cystitis. However, it is important to examine the urinary tract with radiographs or ultrasound to look for stones. Due to the expense, some owners opt not to radiograph or ultrasound the cat on the first visit but, given how common stones are, I would highly recommend checking for stones even on the first visit.

Radiographs and ultrasound each have their pros and cons with respect to imaging the urinary tract and the accuracy/usefulness of each examination method depends on the quality of the equipment and the skill of the operator.

Radiographs - providing there is not a lot of stool in the colon to obscure the view - may reveal a stone in the urethra, whereas U/S will not show this area.

Ultrasound exams have some benefits over radiographs but it is also very highly dependent on operator skill. Ultrasound can pick up stones that may not show up on radiographs.

In some complicated cases, both imaging methods are needed to obtain a diagnosis.

**Treatments** for sterile cystitis include:

1. pain medication
2. increasing water consumption with a canned food diet, etc.
3. decrease the patient’s stress - not always easy since cats can be very ‘silent’ in their stress and we may not always be aware of what is bothering them
4. glucosamine/chondroitin sulfate products such as injectable Adequan, or oral products such as Cosequin, Dasequin, or Trixsyn may help

**Tricks used to increase water consumption:**

1. water fountain
2. flavored waters such as tuna water, chicken or beef broth, clam juice, lactose-free cat milk (CatSip), etc. - can be kept in covered (to prolong fresh smell and taste) ice cube trays
3. add plain water to canned food - 1-2 TBS per meal - or whatever amount your cat likes

You can make your own tuna water by taking a can of tuna and adding 3 cups of water. Break up the tuna and let it sit for awhile (~15 minutes, give or take) and then pour the tuna water into covered ice cube trays.

3 cups of water fills two 16-cube trays.

After warming the flavored ice cubes to ‘mouse body’ temperature you can:

1. add to canned food
2. set out as a separate drink of water

**Subcutaneous fluids** may also need to be administered at home by the owner in order to increase urine flow. However, this can be stressful and is usually reserved only for severe cystitis cases involving dry food and are on their way to transitioning to canned food.

To repeat a very important point: Bladder infections are not a common cause of cystitis. Sadly, the rampant abuse of antibiotics when addressing feline urinary tract issues in cats shows that this fact is being ignored. The most important ‘treatments’ are increasing water consumption and lowering stress.

Cats, unlike other species including humans, have a natural defense mechanism in which they produce a more highly concentrated urine. (USG >1.040) Few self-respecting bacteria want to float around in concentrated cat urine.

Before considering the use of antibiotics in cystitis patients, a culture and sensitivity (C & S), in addition to a standard urinalysis, should be run on urine obtained via cystocentesis. This involves a needle going through the abdominal wall, directly into the bladder. This sounds much worse than it really is. The patient does not feel the needle going in but, instead, may simply object to being held on his or her back.

‘Free-catch’ urine samples (urine voided onto an exam table or into a litter box) should not be used for a C & S due to the issue of contamination which will often give a false positive result. In other words, bacteria will grow on the culture that may not even be in the patient’s bladder or kidney.

The ‘culture’ part of this test shows if an infection exists or not. The ‘sensitivity’ part of the test is run only if a bacterial colony grows. This half of the tests tells us which antibiotic is the best one to choose for the type of bacteria that was grown.

One difficulty that we run into when trying to get a ‘clean’ sample (via cystocentesis) from a cystitis patient is that most of these patients present with an empty
bladder. Or, they void all of their urine once the veterinarian starts to palpate (feel) the bladder through the abdominal wall.

To get around this, the patient can be given a dose of **pain medication** and a dose of **subcutaneous fluids** and placed in a cage without a litter box for 1-3 hours. This should result in the patient’s bladder filling up enough to obtain a sample for a urinalysis and a C & S.

A note about cost: Many veterinarians do not run a C & S on their cystitis patients because they are worried about running up a client’s bill. However, I cannot stress strongly enough that this is often a ‘pay me now or pay me later’ issue.

I have seen countless cases where both the veterinarian and the client are ‘chasing their tail’ by pouring needless antibiotics into their sterile cystitis patients. This not only results in added expense and stress for the client, but please also consider the added stress to the patient’s mind and body and the significant potential for promoting **bacterial resistance**. Most cats are not happy about taking medications and **all medications have negative side-effects**.

This “tail chasing” often results in far more cost to the client than would have been incurred if a C & S would have been run when the patient first presented with clinical signs.

There is a joke in veterinary medicine that states: “Sterile cystitis patients get better in 1 week with antibiotics and in 7 days without antibiotics.”

The good news is that cystitis often resolves within a few days to a week.

The bad news is that it tends to recur - especially in patients that are fed dry food and/or continue to live in a stressful environment.

See below for further discussion of Urinary Tract Infections.

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**Urethral Obstruction - Opie’s Story**

The urethra is the tube that drains urine from the bladder to the outside. It can be partially or completely blocked with mucus, stones, inflammatory cells, or crystals. This is a life-threatening - and very painful - condition which can result in the bladder rupturing within 24 hours of a complete urethral obstruction - leading to death soon after.

**Any cat that is repeatedly entering the litter box but not voiding any urine is in need of IMMEDIATE medical attention!** This is one reason why it is so important to use a clumping (scoopable) litter. Clumping litter allows you to see just how much, if any, urine is being voided.

Males are much more prone to ‘blocking’ than females because the male urethra is much longer and more narrow than a female’s.

The following pictorial shows what “Opie” had to go through when he blocked. It is highly unlikely that he would have had to suffer like this if Man would have been feeding him a proper, species-appropriate diet of **water-rich canned food** instead of dry food. Opie was found lying in a backyard crying - minutes away from rupturing his bladder due to a urethral obstruction.

A one week stay in the emergency clinic resulted in a **$4,000 vet bill**. Another **$350 bill** was incurred 3 weeks later when Opie had to have a stricture broken down in his urethra. Catheterization of the delicate urethra can damage the tissues and result in a stricture which will obstruct urine flow. **Repeated catheterizations can set your cat up for some very serious problems.**

**Opie’s case is a very good illustration of the fact that proper nutrition (NO dry food) is a ‘pay me now or pay me later’ issue.**

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Opie was sedated and a catheter was passed up his urethra in order to break up the obstruction before his bladder ruptured. His bladder was then flushed to try to remove any debris that could cause him to block again.
Flushing his bladder.

Suturing the catheter to his scrotum.

For want of a proper diet...
IV fluids
Urinary catheter
Pain meds

Urine collection bag

Bloody urine draining from his bladder.
Is it possible for a cat to block when on a 100% canned food diet? Yes, it is possible, but it is highly unlikely. When water is flowing through the bladder, crystals, mucus, and cellular debris will be much less apt to build up and cause an obstruction.

Also, when water is flowing through the bladder, the urine is more dilute which is thought to be less irritating to the bladder wall in some cats. Less irritation means less inflammatory cells and mucus to block the urethra.

**Think of canned food as hosing down your cat's bladder many times each day.**

A procedure called a perineal urethrostomy (PU) is often performed on blocked cats with the hope of preventing future obstructions.

A PU removes the penis and part of the urethra and leaves the patient very prone to urinary tract infections for the rest of his life. Also, the surgery site can stricture
at a later time.

I strongly believe that this procedure is performed far too early in many cases before a **properly hydrated diet** is tried. Please give this procedure a lot of thought before consenting to it.

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**Urinary Tract Infections**

Urinary tract infections can occur anywhere along the tract from the kidneys to the urethra. Most infections gain access to the bladder when bacteria travel up the urethra from the outside world. From the bladder, the infection can ascend to the kidneys.

Please note that when the abbreviation "UTI" is used, the 'I' must be defined. Does "I" mean infection? Or does it mean inflammation?

It is very important to understand the difference if we are to **stop overusing antibiotics and start using more pain medications** when cats exhibit signs of urinary tract problems.

Studies have shown that otherwise healthy cats (no kidney disease, diabetes, or hyperthyroidism) - that are showing signs of urinary tract discomfort - have only a ~1-2% chance of having a UT infection yet antibiotics are prescribed very frequently for these patients. The veterinary community needs to address this very serious problem involving the overuse/abuse of antibiotics.

Roughly 96% of these otherwise healthy cats have sterile (no infection) cystitis. This is because the feline is very good at saving water to stay hydrated which results in a very concentrated urine. (Urinary Specific Gravity (USG) >1.040) **Concentrated urine is a very hostile environment that does not readily support bacterial growth. Therefore.....**

**Urinary tract infections are rare in cats without a concurrent disease such as kidney insufficiency, diabetes, or hyperthyroidism.**

What about the other population of cats with diseases such as kidney insufficiency, diabetes, or hyperthyroidism? Cats with chronic kidney disease (CKD) and hyperthyroidism often produce a more dilute urine (USG <1.030) which is a friendlier environment for bacteria. Unregulated diabetic cats often have glucose (sugar) in their urine which makes a nice culture medium for bacteria.

However, even cats with CKD, hyperthyroidism, or diabetes that are showing signs of lower urinary tract disease have a less than 50% chance of having a urinary tract infection. (Several studies have been done in this area and the results have varied but all have shown far less than 50%) This fact illustrates why it is very important to run a culture and sensitivity.

**Urine Culture and Sensitivity (C & S)**

As described above in the Cystitis section, this is a two-part test that is used to check to see if an infection is present (culture) and what antibiotic(s) would be the most appropriate to use for the strain(s) of bacteria present (sensitivity).

Please note that I emphasized "if" in the previous sentence. It is very important to confirm that an infection actually exists rather than to subject your cat to the administration of an unnecessary, and potentially dangerous, antibiotic without proof that it is needed and is the correct one.

Culture results are reported over a period of 3 days - at a minimum. The typical sterile cystitis report will read:

- 24 hours - no growth
- 48 hours - no growth
- 72 hours - no growth

If there is an infection present, the report will read something like "moderate growth of e.coli - sensitivity pending". This means that the next report will give your veterinarian important information necessary to pick the best antibiotic for your cat's infection.

Cultures can be classified in 3 ways:

1) **diagnostic** - the initial culture before starting antibiotics to confirm that an infection is present and to identify the bacteria, assess the number of bacterial colonies to quantify the level of infection (cfu - colony forming units per milliliter of urine), and to determine the organisms' susceptibility to various antibiotics

2) **therapeutic** - performed 3-5 days after starting antibiotics (post-positive diagnostic culture) to assess antibiotic efficacy or it is sometimes performed 3-5 days before cessation of antibiotic administration

3) **surveillance** - performed 7-14 days after the last antibiotic dose to check for relapse or reinfection

**Relapses** are defined as recurrences caused by the same species and strain of microorganism that were found in the diagnostic culture within several weeks of stopping antibiotic therapy.

**Reinfections** are defined as recurrent UT infections caused by a different organism. The only way you can differentiate relapses from reinfections is to compare the results of the initial culture obtained prior to antibiotic usage to those of cultures obtained during and/or after discontinuation of the antibiotic.

Relapses represent antibiotic treatment failures that may result from improper antibiotic choice, dose and duration of therapy, lack of owner or patient compliance, failure of the patient to absorb an orally administered drug, deep-seated infections, failure to identify predisposing factors, or acquired drug resistance.

Reinfections, on the other hand, usually represents failure to recognize and eliminate predisposing factors associated with continuing dysfunction of host defenses, or UT infections caused by procedures such as catheterization. Frequent reinfection is an absolute indication to evaluate the patient for anatomic, metabolic, and immunologic disorders that may compromise normal host defenses.

For a patient's first time infection, therapeutic and surveillance cultures are not usually performed due to cost and added stress for the patient. However, they should be considered in all recurrent UT infection cases, otherwise the veterinarian and owner may find themselves running in circles.

To repeat an important point: Cats with a **urine specific gravity above ~1.040** have a very low chance (~1-2%) of having a urinary tract infection.

Cats with a **USG below ~1.030** have a higher chance of having an infection.

If a patient presents with lower urinary tract signs, and has a low urine specific gravity or is a diabetic cat that is spilling sugar in his urine, and if an in-house analysis of the urine indicates that an infection may be present, the patient may be started on a broad-spectrum antibiotic pending the C & S result.

If the culture turns up negative, the antibiotic can be discontinued. Or if the culture comes up positive but shows that the bacteria are resistant to the antibiotic that has been chosen, the correct antibiotic can be started.

At least in these cases, the needless - or wrong - antibiotic will have been given for only 3 days instead of for a much longer period of time.

A quick note on the long-acting antibiotic called **Convenia**. Because this drug stays in the body for a very long time (up to ~60 days) it is one of the newest antibiotics to be terribly overused/abused. Veterinarians and lay people are seeing it as a quick and easy fix to their problems because they don't have to give it once or twice daily like with other antibiotics. It is typically given by injection once every 2 weeks. However, keep in mind that if an adverse reaction occurs, you cannot retrieve the drug from the body.
Convenia can cause severe anemia. There is a report on VIN (Veterinary Information Network) from a general practitioner who dealt with two cats that died within 10 days of receiving Convenia. They were otherwise healthy cats and had normal red blood cell counts prior to receiving Convenia. There is no absolute proof that Convenia caused their deaths but there is an extremely high index of suspicion that this drug was the culprit.

I also recently dealt with case of severe anemia post-Convenia in an otherwise healthy cat. The emergency clinic was able to save the patient's life after a 1 week stay in the hospital and the bill was over $5,000.

Baytril is another antibiotic that is frequently abused. This drug can cause blindness so I do not take its use lightly.

Clavamox is the most common broad-spectrum antibiotic that is administered to cats. It causes vomiting and/or diarrhea in many cats but it is one of the safer choices of antibiotics. It comes in pill or liquid form. I greatly prefer the pills because they are very palatable and can be crushed and added to canned food. I do not like feeding cats so if your cat will not eat crushed clavamox tablets in tasty canned food or baby food, then use the liquid.

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**Urinalysis/Dietary Issues**

Laboratory analysis of urine (UA) can be done on samples obtained in various ways but you need to be aware that some tests are not accurate on free-catch samples that you have obtained at home.

Due to the delay in testing of the sample (by more than 30 minutes once the urine has been voided), temperature changes, and the lack of sterility of a free-catch sample, interpretation of a urine sample obtained at home can be very misleading.

One example of a test that is accurate is the urine specific gravity. This is also one of the most important numbers on the UA. I routinely (3-4x/year) check my cats' USG from free-catch samples obtained by slipping a flat (versus a deep/narrow) tablespoon under when they are urinating. A low USG can be an early indication of kidney insufficiency.

When assessing a patient's urine concentrating status, it is always much better to take multiple readings so that you can see an average over time - versus relying on just one reading, at one static point in time, from a UA report. Therefore, some people buy their own refractometer in order to check their cat's USG at home. If you do purchase one, make sure that it is labeled for use with urine. The RHC-200 ATC (automatic temperature compensation) linked here has been sold on eBay for as little as $50.

The RHCN-200 ATC is billed as a "Heavy Duty Version of the RHC-200 ATC and features an easy-to-calibrate knob" versus the need to use a small screwdriver (easily lost or misplaced) for the RHC-200 ATC model. Either one will be fine because you don't have to calibrate the unit very often. In fact, my 25 year old one has only been calibrated a few times in its life but I would suggest that you calibrate yours ~once or twice a year with distilled water which will have a specific gravity of 1.000. Calibration is very easy. Just apply a couple of drops of distilled water onto the refractometer 'window' then adjust the refractor line to 1.000 with the screwdriver or the knob.

A urine culture and sensitivity is not accurate from a free-catch sample due to contamination issues. However, on rare occasions we may run a C & S from a midstream sample that is caught in a sterile container but interpretation must take into consideration the collection method. If the C & S comes back negative on a free-catch sample, this result is helpful but if it comes back positive, you cannot be sure if the bacteria are from the bladder/kidney or from the very end of the urinary tract or the patient's hair that surrounds the vulva or penis.

A check for crystals is also not accurate because crystals can form once outside of the bladder in as quickly as 30 minutes. This problem of a 'false positive' can be an issue with urine obtained from a free-catch sample at home, as well as one obtained via cystocentesis that is sent to an outside lab due to the same time delay. If your vet wants to accurately assess for crystals, the urine must be looked at 'in-house' within 30 minutes of cystocentesis or the urine being voided.

pH also may not be accurate in urine samples obtained at home.

A cystocentesis is the best method to obtain urine which will yield the most accurate results.

A few definitions, along with comments:

**pH:**

pH refers to the acidity or alkalinity of, in this case, urine. pH is often mentioned when discussing diet and crystals but is focused on too heavily.

While keeping in mind that cats are obligate carnivores (see Feeding Your Cat: Know the Basics of Feline Nutrition), it is important to understand that a meat-based (carnivorous) diet naturally leads to an mildly acidic urine.

Grains, on the other hand, promote a more alkaline urine due to their carbohydrate level as shown by this [study](#).

Due to Man's focus on profit margin, diets higher in grains (higher in carbohydrates than a cat's natural diet) have flooded the market - along with pet food manufacturers' unscrupulous advertising onslaught designed to persuade the feline caregiver to think that feeding a water-depleted, grain-laden dry food diet constitutes optimal nutrition.

Keep in mind: Meat is expensive. Grains are cheap.

Meat (animal-based protein) promotes a mildly acidic urine which is normal for the cat.

Grains (plant-based protein and high carbohydrate content) promote an alkaline urine.

As mentioned below in the Crystal section, struvite crystals are more apt to form in an alkaline urine and calcium oxylate crystals are more apt to form in an acidic urine. Many "urinary tract" diets - including some of the prescription diets - overly acidify the diet past what would be normal for a cat eating a species-appropriate diet. These diets can dissolve struvite stones but will lead to other problems if they are fed past the therapeutic time frame.

Please understand that we would rarely have to address pH or crystals if cats were fed a water-rich diet. However, because Man insists on feeding cats species-inappropriate, water-depleted diets in the dry form because they are cheaper and more convenient to deal with and because many cats are addicted to them, the cat continues to suffer with urinary tract issues.

For many years, struvite (magnesium, ammonium, and phosphorus) was the predominant mineral mixture found in cat urine due to the species-inappropriate level of grains in cat food. Knowing this, Man then stepped in and started acidifying commercial cat food with things like dl methionine - instead of cutting into profit margin by removing the grains and going back to meat.

The so-called 'urinary tract formulas' were born.

Unfortunately, in trying to fit a cat's unnatural alkaline urinary pH - caused by Man's greed in the first place - pet food manufacturers created even more problems by adding urinary acidifiers in the form of dl methionine, etc., which led to the formation of calcium oxylate (CaO) crystals/stones in many cats. Suddenly, there were far more patients suffering with CaO crystals/stones than there were patients with struvite crystals/stones.

One of the most serious problems with this fact is that CaO stones can only be removed with surgery. There is no way to dissolve them with dietary manipulation. Struvite stones, on the other hand, are more amenable to dissolution with dietary manipulation.

Most stones found in the kidney are CaO and since we cannot dissolve them with dietary manipulation and since surgery to remove kidney stones (versus bladder stones) is a safer option, it is easy to see how damaging the effects of feeding an acidifying diet can be if used for long periods of time.
Other systemic problems, including kidney damage and low potassium, can be seen in conjunction with the feeding of these acidifying diets, as well.

It is also important to note that diet is not the only factor involved in determining urine pH. The timing of the cat's meals is also a factor. 'Post-prandial alkaline tide' refers to the fact that urine pH will become more alkaline after eating a large meal. Therefore, it is suggested that cats eat multiple small meals throughout the day to help keep the pH in a normal range. Small cats in the wild eat 8-10 small meals per day.

If Man would just go back to feeding cats a species-appropriate diet - i.e. - one that has a water content that mimics a cat's normal prey and one that is based on meat, not gains - instead of trying to artificially manipulate a species-inappropriate diet of grains by adding acidifiers, the vast majority of urinary tract problems would be solved.

**Crystals:**
- Crystals are most commonly either calcium oxylate (CaO) or struvite (a mixture of magnesium, ammonium, phosphate).
- Calcium oxylate crystals are more apt to be formed in an acidic environment.
- Struvite crystals are more readily formed in an alkaline environment.

A small amount of crystals is not an abnormal finding in cat urine and the cat should not be automatically put on a prescription diet such as Hill's Prescription c/d, etc.

- Crystals are often erroneously diagnosed because they can form once the urine has been removed from the bladder. Therefore, when urine is sent off to an outside laboratory, or a sample is brought from home, a report of "crystals" is somewhat meaningless since you have no idea if they were actually present within the patient. This misdiagnosis - and overemphasis of the significance of urinary crystals if they are present in the bladder - leads to the client becoming alarmed and the patient needlessly being put on a low quality - and potentially dangerous - diet such as one of the prescription 'urinary tract' diets.

Think of crystals in cat urine like leaves on your driveway. Both are normal findings. However, if you never hose (or sweep....during a water shortage :>)) down your driveway, the leaves will build up and then you won't be able to get your car out of the garage.

If crystals are allowed to build up, the urethra can become blocked leading to a life-threatening situation. A blocked cat can end up with a ruptured bladder - resulting in death - within 12 -24 hours of complete obstruction.

If there is not enough water flowing through the bladder on a regular basis the following will happen with respect to crystals:
1. The urine specific gravity goes up meaning that the urine becomes more concentrated. When this happens, the crystals are more apt to become 'super-saturated' in the urine and form stones.
2. Mechanical removal is compromised. When there is ample water flowing through the bladder the cat will urinate more frequently - voiding up to double the amount of urine per day. This frequent urination of a higher volume of urine helps to remove the crystals instead of letting them build up to block the urethra.
3. If there are large numbers of crystals and the cat also has cystitis (inflammation of the bladder leading to mucus production and cellular debris), the crystals can combine with the mucus and inflammatory cells and make a 'plug' that can block the urethra.

Keep in mind that it is very important to have enough large litter boxes with CLEAN (clumping, scoopable) litter in accessible places so that your cat is very willing to use them frequently and not 'hold their urine'.

More frequent voiding of urine will lower the chances of stones being formed and will make the bladder wall less likely to become inflamed.

Litter boxes should always be scooped at least twice daily.

**Urinary Specific Gravity (USG):**

As noted previously on this webpage, USG is a measurement of the concentration of the urine. It is one of the most important values on the UA report.

USGs should be measured on more than one occasion to check for consistency. A dilute USG would be around 1.015 (stated "ten fifteen") or 1.020 ("ten twenty") and a concentrated urine would be more in the >1.040 range. A USG between these ranges should be monitored to see if it continues to go lower or starts to rise.

**The USG of dry food-fed cats is higher (the urine is more concentrated) than it is for canned food-fed cats.**

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**Prescription Diets**

Please understand that every case is different. The comments I make below are general ones. The optimal diet for each cat experiencing urinary tract problems needs to be discussed individually after all medical records and patient history/information have been reviewed. Advice cannot be given via email. I am available for consultations if you need help beyond the scope of this webpage.

I very rarely use prescription diets. They are expensive and contain low quality, species-inappropriate ingredients, and are not necessary in most cases of feline urinary tract disease. I only consider their use if I know the patient has urinary tract stones ("lithiasis") - or a large amount of crystal/mucous/inflammatory cells ("sludge") (especially when the patient is male) - with a high index of suspicion for them being struvite versus calcium oxylate (CaO).

Males have long, narrow urethras and are much more apt to block than females.

Remember, CaO will not dissolve with diet manipulation and acidifying diets promote the formation of CaO. 'Sludge', in some cases, can be handled with a water-rich diet to flush it out but it is possible to have small stones hiding in this mixture that could be missed on radiographs or ultrasound.

In these cases, I will consider the use of a canned acidifying diet that also promotes dilute urine for a short period of time until the patient shows radiographic or ultrasound evidence of stone dissolution/"sludge" clearance. This can take as little time as 2 weeks but may take 2-3 months.

If the stones are not showing any signs of dissolution once the patient has been on the acidifying diet for 3-4 weeks, there is a good chance that the stones are CaO and keeping them on this type of diet - if the stones/crystals are CaO - is only going to make matters worse. This is why it is so important to monitor the patient with radiographs or ultrasound and urinalyses.

When prescription diets were first formulated, they mainly focused on urinary pH manipulation and magnesium restriction. In recent years, some of the manufacturers such as Purina and Royal Canin have added salt to their diets to encourage higher water consumption in order to dilute the minerals (crystals). There is controversy surrounding this practice.

Prescription urinary tract diets come in dry and canned forms but after reading this webpage, hopefully the reader will understand just how illogical it is to add salt to a dry food diet to get the cat to drink more water when the cat should be eating a water-rich diet of canned food in the first place.

For dry food addicts, please see [Tips for Transitioning Dry Food Addicts to Canned Food](#).
As stated in the first section of this webpage, manipulating the pH of urine is not the most important factor in preventing feline urinary tract diseases yet it is so heavily focused on.

I am finding it increasingly frustrating to watch the veterinary community continue to be fixated on the pH of cat urine and the presence of urinary crystals instead of focusing on the much more important issue of dietary water content.

Many veterinarians have neglected to look at just how illogical it is to feed any cat a water-depleted dry food diet but especially one with urinary tract issues.

Instead of reflexively reaching for the prescription diets when patients present with urinary tract issues, I would like to see the emphasis switch to getting the patient off of all dry food and onto canned food with added water.

When I say it is illogical to feed "any" cat a diet of dry food, think about practicing preventative nutrition. Do you really want to wait until your cat develops urinary tract problems before you implement the feeding of a water-rich diet to a species with an naturally low thirst drive?

Think about closing the barn door before the horse is running down the roadway.

December, 2009
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