

Bladder Stones in Rabbits

Cystic calculi or bladder stones can be seen in all ages and breeds of rabbits. In the past one of the frustrations of treating this disease was the high rate of reoccurrence of stone even after treatment. However, with improved treatment techniques, we have been able to reduce the reoccurrence percentages dramatically. Now let us take a look at this disease in detail as we understand it today.

CAUSES OF URINARY TRACT STONES AND SLUDGE

It is still unclear as to the exact mechanisms that lead to bladder stones or a similar condition called hypercalcinuria in the rabbit. Hypercalcinuria is a high calcium content of the urine where large stones do not form, but rather there is an abundance of smaller crystals that cause the urine to be thick, white and difficult to pass. This condition is often referred to as *bladder sludge*. It is likely that a **combination of factors** is necessary to create sludge and stones in the bladder. Stones or sludge may form in both the kidneys and the ureters that are the tubes that pass urine from the kidneys to the bladder. Most of the stones seen in rabbits are primarily composed of a mineral called *calcium carbonate*. Varying amounts of calcium carbonate are normal in rabbit urine, but what causes the amounts increase in volume or clump together and form stones is not entirely clear.

Before we look at the possible causes of bladder stones or sludge, let me briefly discuss how the rabbit handles calcium in its diet. Digestible calcium is the calcium that can be absorbed by the body and is not bound to another substance preventing its absorption. Calcium is used for a variety of processes, the most common being the maintenance of bone and muscle. Humans and most other domestic animals tend to absorb calcium out of the diet in proportion to what their body needs at that particular time. The calcium that is not needed by the body is passed into the gastrointestinal tract, primarily through bile, and is excreted in the feces. Rabbits, however, have a different method of dealing with digestible calcium in the diet. They tend to **absorb calcium in direct proportion to the digestible calcium that is in the diet whether or not their body needs that extra amount at that moment.** Rabbits then **excrete the excess calcium they don't need primarily through the kidneys.** The calcium is excreted in the urine in the form of calcium carbonate. This substance is what makes normal rabbit urine cloudy in appearance compared to the urine from a human, dog or cat. The calcium carbonate is the white residue seen on the cage paper after the urine is dry. If you touch this residue it feels like chalk. Rabbits may have developed this very efficient way of absorbing calcium out of the diet because of the harsh environments in which they evolved and this mechanism may have been necessary to get all the calcium possible out of a meal in case there was less calcium available in subsequent meals. The complete process of calcium metabolism in the rabbit is complex and still full of mysteries that are yet to be unraveled. However, for the purposes of our discussion, the basic facts are as stated:

1. They can normally can absorb more calcium than they need
2. The excess is excreted through the kidneys.

In addition, the blood calcium level of a rabbit can change dramatically based on whether or not it has recently eaten a calcium-rich meal. If your rabbit is experiencing a high blood calcium level, it is often best to recheck it after removing high digestible calcium sources from the diet for 24 hours for a more accurate reading. Your veterinarian may also be able to test for different forms of calcium, such as ionized calcium, to allow for a more accurate blood calcium reading.

Now let us take a look at some of the factors that might lead to the accumulation of too much calcium carbonate in the urine, or its formation into actual stones.

- **Genetic predisposition** to stone production by that particular rabbit
- **Insufficient water intake by the rabbit.** This could be caused by lack of water (water bowl overturned, water frozen, rabbit doesn't know how to drink out of a water bottle, water bottle defective) or water that has a bad taste or smell (contaminated, has medications or vitamins added). This causes a state of chronic dehydration and may result in more concentrated urine leading to the possibility of sludge or stone formation.
- **Inactivity leading to less frequent urination.** The inactive rabbit that sits all day in a cage may not drink as frequently or urinate as frequently leading to more concentrated urine. An active rabbit will consume more water and urinate more frequently.
- **Lack of appropriate toilet area.** Some rabbits are very fastidious and if they are confined in a small space and the toilet area is not kept clean, they may tend to hold the urine longer and thus urinate less frequently. This could cause similar problems as in 3.
- **Kidney disease** may cause a change in how calcium is excreted or handled. There are a variety of diseases that can affect the kidneys including parasitic, infectious and non-infectious.
- **Bladder disease** may cause a change in the lining of the bladder causing calcium carbonate to accumulate and form stones. Infections, tumors and benign growths can cause inflammation of the bladder wall.
- **Diet high in digestible calcium.** The more calcium absorbed, the more is excreted. Examples of dietary items high in digestible calcium are alfalfa hay and some commercial pellets. Most dark leafy greens have lower digestible calcium per volume of food due to the fact that a portion of the calcium is bound up by oxalates and thus is not able to be absorbed.

The calcium level in the diet has often been blamed entirely for causing the bladder stones in the rabbit. This is not an accurate assessment and in addition I think wrongly directs attention away from other areas that need to be addressed in the treatment of these cases. There have been several scientific studies performed where rabbits were fed huge amounts of digestible calcium, far more than a pet rabbit would ever get even on a completely commercial diet, for months and they were never able to create bladder stones. So I don't believe that diet ALONE is ever the entire problem. However, I believe it can be a contributing factor in the presence of other

problems or disease and changes in the diet may be required in the treatment of this disease.

SIGNS OF URINARY TRACT STONES OR SLUDGE

Early in this disease there may be very few signs or the signs may be so subtle as to be undetected by the rabbit's caretaker. As the disease progresses, any combination of the following may be seen.

- **Urinating more frequently than usual** and often outside the normal toilet area. Frequent inappropriate urination (especially "spraying" urine on vertical surfaces) can be seen as normal behavior in sexually mature intact male and female rabbits that are marking their territory. However, a rabbit that is experiencing bladder problems will usually not "spray" the urine on vertical surfaces, nor seem particularly interested in marking out a territorial boundary or certain items in a room. Occasionally a rabbit will be observed to "dribble urine" without knowing it and the hindquarters may be continually damp with urine. Please be aware that there are other diseases that can lead to urine staining of the hind quarters including sore hock, spinal disorders (arthritis, injuries, nerve damage), obesity (can't clean the hind quarters) and reproductive disorders, to name a few.
- **Straining to urinate.** The rabbit takes longer than usual to pass a smaller than usual amount of urine. This straining behavior is frequently mistaken for constipation. True constipation is an extremely rare event in the rabbit. Occasionally the condition can be so painful that the rabbit will cry out or moan when urinating, although this is rare. You should consider it an emergency if a rabbit is continuously straining without producing urine. This indicates that there may be a complete blockage of the urethra (the tube the urine flows through out of the bladder) and if this is not corrected it could result in the pet's death within 24 hours besides being incredibly painful.
- **Blood in the urine.** Normal rabbit urine can range in color from a light yellow to a deep orange-red (a "rusty" color) due to a variety of plant pigments that may have been eaten or pigments, called *porphyrins*, produced by the bladder itself. Blood coming from the urinary tract should cause the urine to be a uniform dark to bright red color. Often the amount of blood in the urine is so small it can only be detected by testing with a specially treated paper, or by looking at the urine sediment under the microscope. In addition, unless the rabbit is urinating on a light colored surface, this sign can be missed.

*It is important to note that there is another condition that can cause blood to be seen during urination and is often confused with bladder or kidney disease. **Uterine disease in the female rabbit can result in bleeding.** The blood collects in the vagina and when the rabbit urinates, the blood is pushed out usually at the end of urination. In these cases, the blood appears as a centrally located pool within the urine puddle. There may also be clots of blood within the urine pool and finally there may be blood staining the area under the tail and hindquarters of the rabbit, which is usually not seen in bladder disease. Please be aware that these signs represent serious reproductive disease NOT urinary tract disease. The urine will test positive on

a chemical analysis for blood if you bring a sample to your veterinarian and it will be impossible to tell where the blood originated. Therefore, it is critically important that you observe a fresh urine sample and of course have a complete physical examination done on your pet by your veterinarian any time it is suspected that blood is being passed by your pet.

- **Sludge in the urine.** Urine that becomes thick with calcium carbonate crystals is not only difficult to pass, but will tend to stick to the fur around the rabbit's hindquarters. This sludge urine will leave a large amount of grayish - white residue on the fur and in the toilet area as it dries. This material has the consistency of very fine sand or chalk. Remember that a small amount of this material, which in a normal rabbit should not stain the fur, can be seen in normal rabbit urine as it dries as a consequence of clearing excess calcium from the body.

Sometimes larger calcium carbonate particles can be passed which are the consistencies of coarse sand. In rare instances, the rabbit will pass an entire large stone on its own. If this is observed, the pet should still be examined by a veterinarian to determine if additional stones are present in the bladder. Multiple bladder stones are more common than solitary stones in our experience.

- **Loss of appetite and depression.** This sign usually occurs because of pain due to the pressure, size or location of the stones, or because there is a complete blockage of the urethra. If there is blockage of one or more ureters the rabbit can quickly develop kidney failure which will result in severe depression and death within a short time. Loss of appetite and depression should always be considered an emergency in a rabbit regardless of the suspected cause and you should contact your veterinarian immediately.

It goes without saying that if you see any of the above signs in your rabbit that you should contact a veterinarian immediately. If you can collect a urine sample prior to your visit, this may be helpful. (Please see section below on Urinalysis for directions on how to collect the sample).

DIAGNOSIS OF URINARY TRACT CALCULI

- **History and signs of the disease** - As I have mentioned many times in my articles, giving your veterinarian a good history is CRITICAL to the ability to diagnose many disorders. I suggest that you write down a few notes about the problems your pet is having before you get to the veterinarian's office. Include in your notes the duration of disease, changes in your pet's behavior, changes in the rabbit's life style or environment, any remedies you may have already tried and any ideas you may have on the problem your pet is exhibiting.
- **Physical examination** - A thorough physical examination by your veterinarian is an important part of the diagnosis. Occasionally, bladder stones can be felt in the bladder, however, if the stones are small or if the rabbit is uncooperative, they can be missed. Examination of the hindquarters

of the rabbit may reveal sludge or small stones accumulated on the fur and skin. The most important contribution of the physical examination is to determine the overall condition of your pet and the presence of any other contributing disease. Abnormalities such as anemia, weight loss, skin lesions, dental disease, heart or lung abnormalities and abdominal pain or masses are just a few of the things that can be detected on a physical examination.

- **Urinalysis** - A urinalysis can detect abnormal cells and determine the chemical composition of the urine. Urine can be collected from rabbits in a variety of ways.
 1. Free catch - Empty the rabbit's litter box and wipe it out with a paper towel, but do not disinfect it so that there is some odor remaining. When the rabbit urinates in the box, collect the as soon as possible by pouring it into clean glass or plastic container. You can also use a syringe or eyedropper to suction up the urine. Take the sample to your veterinarian as soon as possible, but it may be kept covered in the refrigerator for up to 8 hours. The drawback to this method of collection is that fecal contamination is common which may alter the urinalysis results.
 2. Manual expression. - Your veterinarian or veterinary technician may be able to gently massage and squeeze the bladder in the awake rabbit and cause the pet to urinate. The urine is directed into a collection cup. This method is successful if the rabbit is cooperative and has a full bladder.
 3. Cystocentesis. - This method can be used in either the awake or anesthetized rabbit. The patient is placed on his back and the bladder is grasped by the handler and pulled gently up against the abdomen. A small needle attached to a syringe is then inserted through the abdominal skin and into the bladder. Suction is applied and the urine sample is collected into the syringe. The procedure is accomplished in a few seconds with minimal discomfort to the rabbit. This method allows collection of sterile urine for bacterial culture.
 4. Catheterization. - The rabbit is anesthetized for this procedure. A small soft catheter is placed in the urethra and then passed into the bladder and the urine sample is drawn out into a syringe. This procedure also allows a sterile sample collection for bacterial culture.
- **Radiography (X-rays)** - This is probably the most important diagnostic test to definitively determine if there are calculi in the urinary tract. Calculi are very dense and thus will appear as white areas within the urinary tract. The veterinarian will examine the bladder area, the urethra, ureters and kidneys where stones may form. In addition, if surgery is to be performed, a x-ray of the chest may be performed to evaluate the health of the heart and lungs.
- **Ultrasonography** - Ultrasound is another method of looking at internal organs and may be indicated if a more detailed examination of the kidneys is required. Ultrasound will also detect calculi in the urinary tract as well as other disease in the abdomen (or the chest).

- **Serum biochemistries** - This is a blood test that examines a number of different chemistries indicating the health of various organs of the body. These tests are important to determine the condition of the kidneys (which may be damaged by calculi). The blood calcium level should also be determined as discussed in Part I. In addition, the health of other organs such as the liver, is determined which may be necessary if surgery is being contemplated.
- **Complete Blood Cell Count (CBC)**- This is a blood test that looks at the numbers of white and red blood cells and platelets as well as the types and abnormalities of blood cells A CBC may be indicated if the patient is not in good physical condition because it can detect signs of infection and anemia which may be significant in the treatment regimen.

TREATMENT OF URINARY TRACT CALCULI/SLUDGE

The treatment of urinary tract calculi is based on a number of factors including the overall health of the pet, the location and size of the calculi and the presence of other disease.

- **Surgery** - If the rabbit has bladder calculi, it will be necessary to surgically remove them. There are currently no diets that will dissolve these calculi. The calculi will increase in size over time if they are not removed and may lodge in the urethra causing a life-threatening bladder obstruction. A bacterial culture of the bladder wall should be performed during surgery to detect any underlying infection. The hospital stay will depend on the surgery and the patient but may range on average from one to four days.

In cases where the calculi are in the kidneys or ureters, surgery may still be an option, but there is a higher risk of post-surgical complications. Kidney function should be evaluated prior to any surgery in this area. Kidney function can be evaluated through blood tests, dye studies and ultrasonography. Most cases of bladder sludge do not require surgery unless there is a blockage present.

- **Catheterization and flushing of the bladder** - Bladder sludge is usually treatable by anesthetizing the bunny, placing a catheter into the bladder and flushing the bladder with saline to dilute the sludge material. The diluted material is then suctioned out into a syringe and the process repeated multiple times until the bladder sludge is significantly reduced. Additionally, the urine can be cultured during this procedure.
- **Diuresis** (increasing water intake) - **This is an extremely important part of the treatment of urinary disease.** Diuresis means increasing the water intake so that more urine is produced. This has the effect of diluting the urine and thereby decreasing the chances of further stones from forming. Fluids can be given intravenously, subcutaneously, intraperitoneally as well as orally. Diuresis will be performed in the veterinary hospital and should be continued at home (see next section on Long Term Treatment).

- **Analgesics** - Analgesics (pain relievers) should be used after surgery or catheterization. The length of time that pain relievers should be used depends on the procedure and the patient. Once a rabbit is urinating normally, moving about without discomfort and eating well, analgesics can be discontinued.
- **Vitamin C or cranberry tablets** - Vitamin C can aid in the healing of the damaged urinary tract tissue after surgery or catheterization. In addition, studies have demonstrated that the levels of ascorbic acid (vitamin C) in rabbits under stress drop dramatically. Since disease or surgical procedures can cause stress it is likely that vitamin C will be of benefit in these cases. Studies in humans indicate that cranberry juice contains alpha D-mannopyranoside that helps to prevent bacteria from adhering to the bladder wall. In addition it is a good source of vitamin C. Therefore you can supplement rabbits healing from urinary tract disease with cranberry tablets based on their vitamin C content at 25 to 50 mg of vitamin C per pound of body weight one to two times daily. Do not use cranberry juice cocktail, which has very little cranberry juice and in addition are loaded with sugar. If cranberry tablets are not available, use regular chewable vitamin C tablets for the vitamin C source.
- **Antibiotics** - Antibiotics may be prescribed after surgery or catheterization particularly if a bladder infection is suspected.

NOT USEFUL:

- **Urinary acidifiers** - Due to the fact that rabbits are herbivores their urine is normally alkaline. Using products designed to make the urine more acidic not only do not work, but in some cases could be harmful. This is different than the situation in cats which are carnivores with naturally acidic urine. In cats with bladder stones it is a common practice to administer urinary acidifiers to prevent further stone formation.

TREATMENT AND PREVENTION OF CALCULI/SLUDGE

Although there is no guarantee that urinary tract calculi will not return after treatment, you can greatly reduce your pet's chances of dealing with the problem again by using the following suggestions.

- ***Increase water consumption** - I consider this to **be the most important factor in the prevention of the reoccurrence of urinary calculi**. If the urine is kept dilute, the possibility of stone formation is dramatically decreased. Feeding fresh leafy greens with increase water intake (See note on this below) In addition, use a sweet flavoring substance in the drinking water to encourage your pet to drink considerably more. Natural fruit juices, with **no** added sugars such as high fructose corn syrup, are an excellent flavoring choice. Test various juices by administering them directly to your rabbit undiluted in a syringe. If your pet takes the juice willingly then try adding it to the drinking water. Record how much water is consumed daily by your pet (this is easy with sipper bottles as they are often marked on the outside into ounces). Use fresh flavored water daily and gradually decrease the amount of flavoring until you see that the rabbit decreases its water consumption. At this point, increase the flavoring just enough to increase

water consumption again and continue to use that amount of flavoring daily. Some flavorings that people have reported success with include pineapple, grape, apple and cherry juice and apricot, peach or pear nectar. Gatorade can also be used, but contains more sugar than natural fruit juices and should be used as a last resort.

- **Remove commercial food (pellets)/alfalfa hay from the diet** - As discussed previously in this article the level of calcium in the diet is not the only factor in causing urinary calculi. However, excessive amounts of calcium above and beyond what the pet needs on a daily basis may add to the calcium content of the urine and be a problem in a rabbit that is already experiencing urinary calculi. Commercial rabbit diets are packed with digestible calcium and I recommend removing them from the diet. Alfalfa hay also has a very high digestible calcium content and should be removed. I do not recommend the feeding of pelleted foods in general due to other problems such as obesity and gastrointestinal tract disorders. The recommended diet for a house rabbit is grass hay along with large amounts of fresh leafy greens, and some fruits and other vegetables.

***Caution:** do not completely remove commercial rabbit food from a rabbit that has never eaten anything else unless he/she has demonstrated that he/she will eat grass hay and fresh greens first.

- **Feed large amounts of fresh leafy greens** - Fresh leafy greens are not only an excellent source of fluid for the rabbit (to keep the urine dilute) but also contain a variety of nutrients (including vitamin C) and fiber (for the digestive tract). Use dark leafy greens that are richer in nutrients than the pale green types. Feed a minimum of three different types of greens daily, don't stick to just one type. Examples of greens to feed include kale, mustard greens, dandelion greens, parsley, cilantro, chard, beet tops, carrot tops, raspberry leaves, broccoli leaves, and Romaine lettuce

As mentioned previously, although the calcium content of dark leafy greens is higher than some other foods, it is not all digestible and doesn't approach the level of commercial pellets or alfalfa hay. NEVER attempt to remove all calcium sources from a rabbit's diet or problems with abnormally low calcium blood levels, such as bone, dental and muscle disease can occur.

We do not consider feeding dark leafy greens a part of the problem causing urinary calculi and in fact we consider these foods to be an essential part of a healthy rabbit diet.

- **Exercise** - Exercise is extremely important to cause the rabbit to urinate more frequently as well as take in more water. In addition to helping with the urinary problem, exercise helps to strengthen bones and improve the rabbit's mental attitude.
- **Routine veterinary checkups** - It is necessary to follow up your pet's progress with routine rechecks with your veterinarian. A urinalysis should be performed several times during the first few weeks after surgery or

catheterization to detect any infection or increase in mineral formation. A physical examination should be performed post-surgically to evaluate healing of the bladder and abdomen. Radiographs should be performed within six months initial treatment to look for the return of stones or sludge in the urinary tract. Please follow your veterinarian's recommendations on recheck visits.

FINAL WORD

Fifteen to twenty years ago when we first dealt with rabbits that had urinary tract calculi the prognosis for successful treatment and further prevention was dismal. Many rabbits were euthanized because reoccurrence of the disease was so common. Thankfully today with a better understanding of this disorder and improved techniques for working with rabbits the prognosis is tremendously improved. We now see the majority of rabbits recover completely from this problem with no reoccurrence. Although the prognosis must remain guarded because each patient has his or her own individual response to therapy, a diagnosis of urinary tract calculi need not be the death sentence it was just a few years ago.