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# Nutrition Response Testing® in the Dissolution of Persistent Cystoliths and Choleliths in a Miniature Schnauzer

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## Abbreviations

| | |
|---|---|
| AK | Applied kinesiology |
| ANS | Autonomic nervous system |
| NRT | Nutrition Response Testing® |
| QOL | Quality of life |
| UA | Urinalysis |
| UTI | Urinary tract infection |

## Abstract

A 10-year-old, 5 kg, spayed female Miniature Schnauzer presented with a history of long-term urolithiasis that had recurred and persisted despite conventional medical management. After 2 cystotomies, the owner did not want to pursue another surgery when the dog was diagnosed with cystoliths complicated by hyperlipidemia and choleliths. The owner sought alternative treatment, and the dog was referred for Nutrition Response Testing® (NRT). The base diet was changed to a minimally processed, whole-food, homemade diet. A nutritional supplement program was designed using NRT. Dissolution of both the uroliths and the choleliths occurred within 3 months, and the dog's overall quality of life (QOL) improved significantly.

**Editor's note:** This patient has a long history prior to presentation to the author. For clarity and consistency with the tables, all days displayed as negative numbers indicate the time prior to presentation to the author.

## Case Report

A 10-year-old, 5 kg, spayed female Miniature Schnauzer presented for Nutrition Response Testing® (NRT) for the treatment of recurrent cystoliths and chronic choleliths (day 1). According to the owner the dog underwent her first cystotomy at 4 months of age with urolith analysis showing struvite (magnesium ammonium phosphate) composition. She was placed on a kibble prescription diet to prevent the recurrence of uroliths (a). A prescription low-fat kibble diet (b) was added to the urolith diet after she was diagnosed with pancreatitis as a young adult dog.

Medical records presented by the owner showed that approximately 2 years before presentation to this author (day -767), the dog had been seen by an emergency clinic for frequent urination. Cystoliths were again found on radiographs, and the dog was placed on a different prescription kibble diet for urolith dissolution (c). A urine culture and sensitivity grew *Staphylococcus pseudintermedius* sensitive to amoxicillin/clavulanic acid. This record showed her weight as 5 kg at the time. Amoxicillin/clavulanic acid (d) was started at 62.5mg (1 ml PO *q* 12 h for 7 days). She had been eating that diet for approximately 2 months when she presented to her previous veterinary clinic with urethral obstruction due to urolithiasis, resulting in an emergency cystotomy, her second such surgery. The antibiotic was changed to orbifloxacin (30 mg/ml, 1.2 ml PO *q* 24 h for 16 days) (e). The recommendation was made for the

patient to remain on the prescription kibble diet for urolithiasis (c) for the rest of her life.

Approximately 13 months (day -403) prior to presentation to this author, the dog was seen by another veterinarian in this author's clinic. The owner reported a history of urolithiasis and elevated liver enzymes (ALT 145 U/L, ALKP 305 U/L). The patient was not manifesting any signs of disease at that time and had remained on the prescription urolith dissolution diet. Vulvar conformation was noted to be normal. The body condition score was rated 7 out of 10, with a weight of 6.7 kg. Due to the history of elevated liver enzymes, a serum chemistry profile, bile acids, CBC, T4, and urine culture were submitted (**Table 1**). The CBC and T4 were within normal limits. Fecal, heartworm, Lyme, *Ehrlichia*, and *Anaplasma* tests (f) were all negative. The patient had shown no clinical signs of pancreatitis while she was a patient in this clinic. The dog was prescribed an oral S-adenosylmethionine/silybin supplement (g) (112.5 mg PO *q* 24 h) and ursodiol (75 mg PO *q* 24 h).

Abdominal ultrasound 2 weeks after presentation to this author's colleague (day -386) showed a large amount of sludge in the gallbladder, and uroliths were present in both the kidneys and bladder (**Table 2**). An abnormality was also noted on the spleen (3 cm hypoechoic area) but was not thought to be neoplastic and was not pursued further. The owner declined the recommendation for another cystotomy, and the dog was changed to the previous brand of prescription kibble diet for urolith dissolution (a). In addition, the patient was placed on amoxicillin/clavulanic acid (125 mg PO *q* 12 h for 63 days), as *Staphylococcus haemolyticus* sensitive to amoxicillin/clavulanic acid was cultured. After a consult with a board-certified veterinary internist 2 weeks later to discuss the elevated liver enzymes and bile acids, the patient was placed back on a prescription low-fat kibble diet for hyperlipidemia (b) and taken off the urolith dissolution diet. The attending veterinarian also contacted the prescription dog food company's consultant, who confirmed that their low-fat diet was appropriate for cystolith dissolution while continuing antibiotic therapy.

Ultrasound was performed every 2 weeks for 2 months (days -365, -351, and -323) and again 6 months later (day -179), each time finding enlargement of the cystoliths (**Table 2**). Urinalysis (UA) was submitted frequently to screen for recurrence of infection (**Table 3**). Encouraging increased water intake was recommended to the owner, and compliance with this recommendation is likely reflected in the lower urine specific gravity measurements during this time. The antibiotic therapy was continued for 2 months.

Bloodwork was repeated approximately 2 months (day -351) after presentation to this author's colleague, showing persistently elevated cholesterol and triglycerides (**Table 1**). The patient's diet was changed back to a prescription kibble diet for urolith dissolution (a), since the low-fat diet had not significantly improved hyperlipidemia and cystoliths had not gotten smaller. After another month on the urolith diet (day -323), an ultrasound showed no evidence of dissolution of cystoliths, and a cystotomy was recommended (**Table 2**). Since the cystoliths were not dissolving and liver values were slowly improving, the recommendation was made to go back on a low-fat diet (b) as her hyperlipidemia was worsening. She was taken off antibiotics (day -309), and

**Table 2: Urolith and cholelith sizes evaluated by ultrasound**

| Date | Cystoliths | Nephroliths Right Kidney | Nephroliths Left Kidney | Choleliths |
|---|---|---|---|---|
| Day -386 | Multiple 1 mm | 1.3 mm x 2.3 mm | 4 mm x 1.5 mm | Sludge |
| Day -365 | Multiple 1 mm | Not evaluated | Not evaluated | Not evaluated |
| Day -351 | Multiple 1-1.5 mm | Not evaluated | Not evaluated | Not evaluated |
| Day -323 | Multiple 1-2 mm | Not evaluated | Not evaluated | Not evaluated |
| Day -179 | Multiple 2-3 mm | 1 mm x 2 mm | 4 mm x 1.5 mm | Sludge |
| Day -42 | Multiple 2-5 mm | Not evaluated | Not evaluated | Multiple up to 2 mm |
| Day -20 | Multiple 2- 6.4 mm | 1.8 mm | 2.5 mm | Multiple up to 4 mm |

**Table 1: Blood levels of liver enzymes and lipids, with normal ranges shown in parentheses.**

| Date | ALT (18-121) U/L | ALKP (5-160) U/L | AST (16-55) U/L | Cholesterol (131-345) mg/dL | Triglycerides (20-150) mg/dL | Bile Acids Pre (0.0-6.9) / Post (0.0-14.9) umol/L |
|---|---|---|---|---|---|---|
| Day -403 | 276 | 1012 | 76 | 823 | 1605 | 35.6/55.7 |
| Day -351 | 190 | 502 | 39 | 713 | 1718 | N/A |
| Day -323 | 110 | 410 | 51 | 786 | 2619 | 25.0/40.4 |
| Day -179 | 170 | 666 | 37 | 823 | 1605 | 83.3/21.9 |
| Day -47 | 185 | 303 | N/A | 572 | N/A | 123.8/47.4 |


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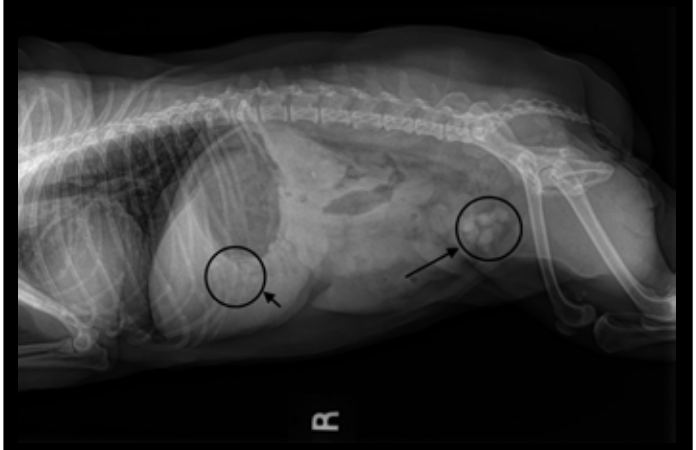
a culture and sensitivity 10 days later (day -299) showed no growth. The owner declined a cystotomy since the dog showed no signs of disease.

At her annual physical exam the following year (day -47), the dog had lost 0.7 kg (body condition score was 6 out of 10), and cystoliths were now palpable in the bladder. On bladder ultrasound, cystoliths were increased in size and number (**Table 2**). Radiographs were taken to evaluate the cystoliths (**Figure 1**). Choleliths were now present. The owner decided to try dissolving the cystoliths again with diet (a) and antibiotics (amoxicillin/clavulanic acid 125 mg PO *q* 12 h for 28 days) based on culture and sensitivity. Recheck radiographs (**Figure 2**) and ultrasound were performed 4 weeks later (day -20). Both studies showed that the choleliths and cystoliths were enlarging. The recommendation was made to the owner for a surgical referral for a cholecystectomy. The owner declined the referral and communicated to the attending veterinarian that she would seek alternative care. She was referred to this author for NRT to try to dissolve the cystoliths with diet and dietary supplements.

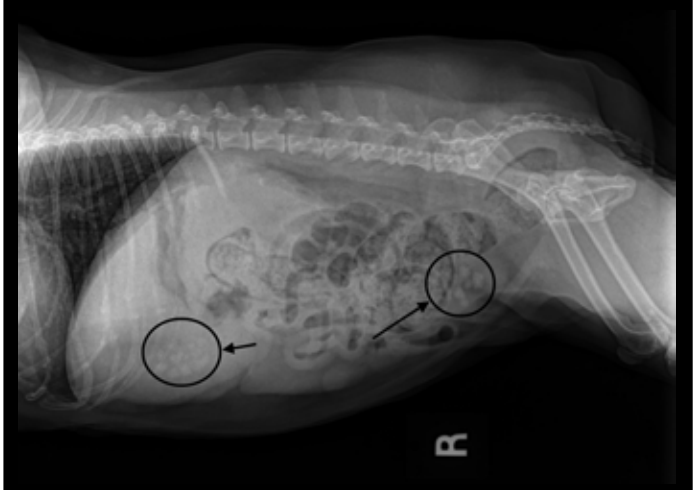
The patient was presented to this author for NRT (day 1). Autonomic Nervous System (ANS) tests were normal. Weak dermatomes were identified as the heart, thymus, liver, and bladder, with bladder the priority. Underlying chemical toxicities (asbestos and alcohol) were found affecting the bladder. She tested for a homeopathic detoxosode (h) to address the chemical toxicity. She also tested for an arginase-rich supplement (i) and a niacinamide/pyridoxine supplement (j) as nutritional support for the bladder. Heart, thymus, and liver dermatomes were strong after adding these supplements. Pancreatic enzymes (k) were added as a digestive aid for the supplements because a digestive dermatome was weak. Dosage was determined

**Figure 1**



Radiograph taken day -47. Choleliths are encircled and indicated by the short arrow. Cystoliths are encircled and indicated by the long arrow.

**Figure 2**



Radiograph taken day -20 showing no dissolution of choleliths or cystoliths on prescription diet. Choleliths are encircled and indicated by the short arrow. Cystoliths are encircled and indicated by the long arrow.

**Table 3: Urine Analysis Results**

| Date | WBC (0-5/hpf) | RBC (0-5/hpf) | Bacteria | pH | Urine Specific Gravity |
|---|---|---|---|---|---|
| Day -386 | 5-15 | 0-2 | Cocci 2+ | 6.0 | 1.025 |
| Day -365 | Neg | Neg | Neg | 7.0 | 1.020 |
| Day -343 | 0-2 | 0-1 | Neg | 6.0 | 1.020 |
| Day -323 | Neg | Neg | Neg | 6.5 | 1.025 |
| Day -313 | 0-2 | Neg | Neg | 6.0 | 1.025 |
| Day -179 | 0-1 | 0-1 | Neg | 7.5 | 1.010 |
| Day -46 | 2-5 | 0-2 | Rods/Cocci 9-40/hpf | 7.5 | 1.018 |
| Day 91 | TNTC | 0-1 | Cocci 2+ | 6.0 | 1.032 |
| Day 105 | 0-1 | Neg | Neg | 6.5 | 1.042 |

using Applied Kinesiology (AK). A minimally processed, whole-food, homemade diet (1) was recommended and instituted by the owner.

This dog returned for a recheck a week later (day 7). The owner reported that she was taking the supplements well, loved her fresh food diet, and had more energy. Repeat NRT testing found all previously weak areas were now strong. Phosphoric acid (l) was added to her supplement protocol to help dissolve the cystoliths. The dosage was determined by AK. Dosages of previous supplements were rechecked and adjusted with AK, including a decrease in the niacinamide/pyridoxine.

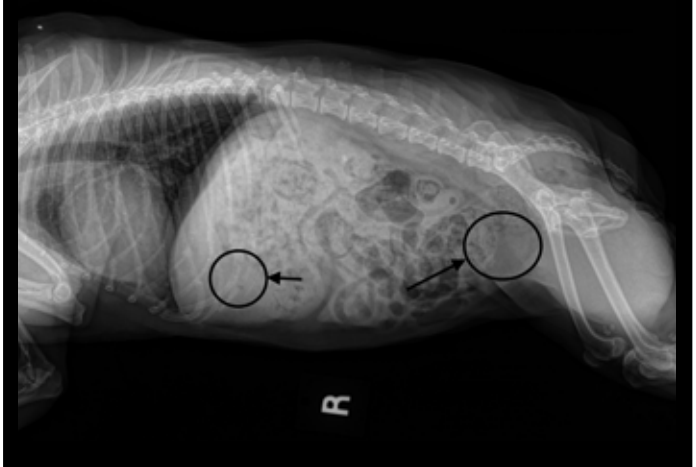
At the follow-up visit 2 weeks later (day 21), the owner reported her dog was doing very well, more energetic and interactive. Retesting with NRT found her liver was weak and was now the priority. A whole-food liver supplement (m) was added to her protocol with the dosage determined by AK. She tested for decreased dosages of all previous supplements at this visit.

The dog's next recheck visit was 6 weeks later (day 63). The owner reported that her urination was normal with a good stream, and the dog appeared more energetic. However, she had started licking her front paws. The owner inquired if there were any supplements that would help her teeth due to her history of dental disease. The owner declined further diagnostics as the dog was well, and the owner would not pursue other therapies if indicated by these tests. She did agree to radiographs to recheck for cystoliths. Testing by NRT showed heart, thymus, liver, and bladder were still strong, and testing by AK showed that the dog no longer needed niacinamide/pyridoxine, pancreatic enzymes or the homeopathic detoxosode. Subsequently, this author was willing to pursue further problems and add other supplements. This dog's feet and teeth tested weak, and a dental supplement (n) was added to her protocol which made both the teeth and feet test strong. She tested for lower doses of the arginase-rich whole-food supplement and the phosphoric acid supplement, and for an increased amount of the liver supplement. Recheck radiographs were planned for the next NRT visit.

The dog visited the clinic 4 weeks later (day 91) for pollakiuria and urinating in the house. She was seen by another veterinarian. On physical exam, no cystoliths were palpated in the bladder. The UA was consistent with a urinary tract infection (UTI) (**Table 3**). She was empirically prescribed marbofloxacin (25 mg PO *q* 24 h for 14 days) (o).

This dog presented for NRT approximately 1 week later (day 98). The owner reported that the pollakiuria and urinating in house had resolved within a day of starting antibiotics. The owner also reported that her dog would occasionally lick her feet but significantly less frequently than at her last NRT visit. Radiographs showed complete dissolution of both the cystoliths and choleliths (**Figure 3**).

**Figure 3**



Radiograph taken day -98 showing complete dissolution of both choleliths (short arrow) and cystoliths (long arrow).

This author last saw this dog approximately 7 months after the initial presentation for NRT (day 217). The owner reported she was feeling great, playing, energetic, and interactive, more than she had been for several years. She developed vomiting, inappetence, and lethargy 2 days later after ingesting an 81 mg aspirin pill and was taken to the emergency hospital. An enlarged liver and a mid-abdominal mass were seen on radiographs. Due to the dog's age and comorbidities, the owner elected euthanasia.

## Commentary

Applied Kinesiology (AK) is a technique that was developed by George Goodheart, DC, in the 1960s (2). It is used to analyze the body or choose therapy by testing muscles for strength or weakness and is often referred to as "muscle testing." Steady pressure is applied to a patient's muscle group, usually an arm, until the muscle locks into place (strong) or the arm gives way (weak). Freddie Ulan, DC, applied AK to nutritional supplements in the 1990s and developed NRT (3). This method analyzes a body to find the underlying causes of poor health and choose nutritional supplements to help the patient overcome these barriers to good health. The goal of NRT is to give the body what it needs to improve overall physiological function and allow it to heal.

Through a 13-step process, NRT is used to energetically evaluate the body and make nutritional recommendations,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including improving the base diet and introducing nutritional supplements (4). The first 2 steps evaluate the ANS. The ANS regulates organ and system functions. If the ANS is not functioning appropriately, the organ may not respond appropriately to nutritional intervention. The ANS responds in predictable ways. Therefore, if a muscle test that is supposed to be weak is strong, or a muscle test that is supposed to be strong is weak, that is considered "ANS dysfunction." If there is ANS dysfunction, the practitioner must determine if any underlying stressors are affecting ANS function.

Stressors routinely tested with NRT include food sensitivities, immune challenges, heavy metals, chemical toxicities, and scars. If any of these stressors are present, the practitioner will get a change in muscle response from weak to strong or strong to weak, depending on the test being done. These stressors are tested by placing homeopathic resonances in test kits on the body. Homeopathic resonances are energy signatures of a particular substance in a vial, asbestos and alcohol in this case. If stressors are found, nutritional supplements, homeopathic medicines, or herbal formulas are chosen to counter these stressors. They are tested by placing each supplement on the body before testing the muscle. A supplement, homeopathic medicine, or herbal formula is chosen based on a change in muscle response from the dysfunctional response to the appropriate response for that test. For example, in this case the dog tested positive for chemical toxicities, and a homeopathic detoxosode was used to remove the chemicals from her body. Any supplement can be tested, and many may need to be tested before finding the appropriate muscle response. Most NRT practitioners have test kits for products from many different companies. They may need to check products from more than one company before finding the correct muscle response and, therefore, the right supplement.

A body scan is then performed using the dermatomes of the organs to evaluate them using AK. A dermatome is an area of skin innervated by a branch of the nerve also innervating the organ and can be used to evaluate that organ. There are 33 major organ dermatomes checked in a basic body scan of a female, 32 in a male. A strong muscle response indicates that the organ is functioning well, and a weak muscle response indicates an organ that is deficient. If there are multiple weak dermatomes, a priority testing technique is used. The stressors (foods, immune challenges, heavy metals, chemicals, and scars) are also checked against the priority weak organ to see if they are factors that need to be addressed. Nutritional supplements are chosen based on what makes that organ strong. These steps are repeated until all weak dermatomes have been addressed and made strong with supplements, herbs, or homeopathic medicines. Once a program is found to make everything strong, digestive and allergy dermatomes are checked to ensure the supplements will not cause problems.

The body is dynamic. Whenever something new is added, change occurs. Therefore, follow-up visits are needed to check for changes and address any new, recurrent, or persistent weaknesses. For example, after starting to mobilize toxins in the body, the liver dermatome will often be weak because liver support is needed to process these toxins, as in this dog.

In people, AK is usually done using a muscle group on the individual being tested. If the individual cannot be tested because they are too weak for prolonged testing or too young or mentally impaired to follow directions, an indirect tester is used. An indirect tester acts as an energetic extension cord for the patient, as electromagnetic energy can flow from person to person. However, the indirect tester must be energetically neutral, or they could confuse the system. Therefore, the indirect tester must be tested before being used to ensure they have no ANS dysfunction or weak dermatomes. With animals, an indirect tester is necessary, as an animal is not able to follow the direction to hold an arm or leg in place against pressure (**Figure 4**).

**Figure 4**

Using an indirect tester for Applied Kinesiology on an animal.

Urolithiasis is a common and often recurrent problem in dogs. Treatment of urolithiasis depends upon the composition of the uroliths (5). Struvite (magnesium ammonium phosphate) and calcium oxalate comprise most cases of urolithiasis in dogs. At the University of Minnesota Urolith Center, more struvite (41%) composition uroliths were analyzed than calcium oxalate (35%) (6). At the University California at Davis Gerald V. Ling Urinary Stone Analysis Laboratory, there was a higher incidence of calcium oxalate uroliths (47%) than struvite uroliths (41.8%) (7). Infection with urease-producing bacteria (*Staphylococcus* spp) is a risk factor in the development of struvite cystoliths (5–7). Medical management is recommended for struvite cystoliths with prescription diets for urolith dissolution (5). Antibiotics are recommended until dissolution is complete if an infection is present (5). Prescription dissolution diets are effective in over 50% of the struvite cystoliths with an average time to dissolution of 35 days and a range of 13–167 days (8). Calcium oxalate cystoliths are not amenable to dissolution with diet (5). Cystotomy is an invasive way to remove cystoliths but may be needed if a dog presents with an obstruction, the dissolution of cystoliths is not successful, or they cannot be removed via cystoscopy or lithotripsy (5). Although age, breed, sex, neuter status, and infection are risk factors for urolithiasis formation, specific physiologic causes of cystolith formation are unknown (7). Female dogs are more at risk for struvite cystoliths because of their increased risk of urinary tract infection (7). Struvite uroliths are more likely to occur in younger dogs (<7 years) compared to calcium oxalate uroliths, although struvite uroliths occur at any age (7). Miniature Schnauzers are at increased risk of forming calcium oxalate uroliths compared to other breeds, but there is no breed predilection for struvite uroliths (7).

Several factors make it likely that the cystoliths in this dog were of struvite composition when presented to the author: Previous stones were struvite composition and *Staphylococcus pseudintermedius* and *Staphylococcus haemolyticus* were cultured in the urine.

Because of the complicating factor of hyperlipidemia, this dog did not remain on a urolith dissolution diet for the entire attempt to dissolve these cystoliths with a prescription diet and antibiotics. She had been placed on a low-fat diet for periods to try to improve her hyperlipidemia. The effect of the diet shifts is reflected in urine pH (**Table 3**), which was lower when she was on the urolith diet than when she was on the low-fat diet. This change in pH also indicates that the owner was likely compliant with feeding the recommended diets. Acidic urine is preferable for the dissolution of struvite stones (5). The low-fat diet may have been a reason why urolith dissolution was unsuccessful with the original medical management because it was not acidifying. However, this dog was on a urolith dissolution diet and antibiotics for weeks at a time, with a corresponding increase in the size of the uroliths (**Table 2**). Antibiotics were chosen based on culture and sensitivity, and culture after the completion of antibiotics was negative, indicating that persistent infection may not have been the reason for failure in dissolution before referral for NRT. She did have a recurrence of UTI after starting NRT, potentially due to the release of bacteria from the uroliths as they dissolved. The UA was normal after antibiotic treatment. Although urine culture is the gold standard for detecting UTIs, the owner declined a urine culture after starting NRT, making long-term infection status unknown.

There are 4 plausible reasons for the disappearance of the cystoliths: the passage of the stones; the change in the base diet to a minimally processed, whole-food diet; the supplement program instituted using NRT; or a combination of the above. Due to the history in this case, it is unlikely that spontaneous dissolution or passage of multiple stones occurred. This dog had cystoliths for years, developing more within months of removal via cystotomy. Moreover, dissolution did not occur when antimicrobials and prescription diets were instituted for over a year.

The base diet change may have contributed to dissolution in several ways. Minimally processed, whole-food diets allow for a more evolutionarily appropriate macronutrient balance than kibble (9, 10). The animal protein and fats are higher than in kibble diets, and the carbohydrate content is lower, leading to more acidic urine. The urine pH was as low with the homemade diet as it was while on the prescription diet for uroliths (**Table 3**). A homemade diet also significantly changes the gut microbiome, which could contribute to the inhibition of the growth of pathogens that could have been perpetuating the cystoliths in this dog (11). The microbiome is important in immunity and immune response to disease (12). Dysbiosis can lead to increased inflammation in the body and susceptibility to infection (12, 13). Systemic inflammation is a risk factor in the development of nephroliths in people (14).

The underlying cause of the cystoliths in this dog were identified with NRT as being a chemical toxicity. In addressing that with a homeopathic detoxosode, nutrition became more effective. The NRT system works by enabling the detection of the underlying causes of disease and addressing them. This dog had been on a urolith dissolution diet since she was 4 months old, yet at 9 years of age was diagnosed with uroliths. The dog's history indicates the likelihood of an


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underlying reason, and using NRT that reason was found to be chemical toxicity. The chemicals may have led to tissue damage and contributed to overall body inflammation. Once this was addressed, the uroliths were able to be dissolved with diet and supplements.

This dog tested for a supplement high in arginase, which helps protect from ammonia, a component of struvite crystals (15). Interestingly, urine specific gravity became more concentrated after changing to a moisture-rich homemade diet. Perhaps the lower urine specific gravity values during traditional medical management were due to mild renal insufficiency, and the addition of the arginase, a kidney supplement, improved kidney function and increased her ability to concentrate urine. Kidneys are a detoxifying organ, and increased renal function may have been a factor in improving quality of life (QOL). She also initially tested for niacinamide and pyridoxine. Niacinamide can decrease blood phosphate levels, which may provide a mechanism of action for reducing the phosphate component of the struvite cystoliths (16). She later tested for a phosphoric acid supplement that may have aided in acidifying the urine and dissolving the cystoliths. Pancreatic enzymes were added to ensure the maximum benefit of the dietary changes and supplements and did not likely have a direct effect on the cystoliths. This supplement regime is complex. Dosages and interactions between the supplements would be difficult to predict without using AK.

Canine cholelithiasis is uncommon and is often considered an incidental finding on ultrasound, with most dogs being asymptomatic (17). Although rare, complications of cholelithiasis can be severe, including bile duct obstruction, cholecystitis, and gallbladder rupture with resultant peritonitis (17). Because of the risk for severe disease with cholelithiasis, general practice veterinarians often refer dogs to specialists for workup and surgical intervention (cholecystectomy) (18).

The Miniature Schnauzer breed has a predisposition to primary hyperlipidemia, especially hypertriglyceridemia (19). Possible complications of hyperlipidemia include pancreatitis, liver disease, atherosclerosis, ocular disease, and seizures (20). This dog had pancreatitis at a young age but was not showing any signs of this during the medical treatment for urolithiasis. She did have high bile acids and, therefore, liver disease. Management of primary hyperlipidemia in dogs is achieved by the administration of low-fat diets with or without the administration of lipid-lowering drugs such as omega-3 fatty acids, fibrates, niacin, and statins (20). Medical management in this dog did not go beyond the low-fat diet. Because diet was not successful in lowering hyperlipidemia, other therapies could have been instituted. When this case presented, the only published study on the use of fibrates in dogs studied bezafibrate (21). This study excluded dogs with moderate to severe elevation of ALT due to the potential for hepatotoxicity seen in humans (21, 22). An additional side effect of fibrates in humans is the formation of choleliths secondary to cholesterol saturation of bile acids (23). Fibrate use is contraindicated in humans with liver and gallbladder disease (22). Therefore, fibrate therapy would not have been a good choice in this dog with elevated bile acids and choleliths. A study on atorvastatin in dogs also found potential hepatotoxicity and gallbladder damage (24). With the comorbidities found in this dog, only fish oil and niacin could have been used to treat this dog's hyperlipidemia prior to NRT.

Hyperlipidemia is linked to cholesterol choleliths in dogs (25). Since this dog was chronically hyperlipidemic, this is a likely cause of her choleliths. It has been suggested in the human literature that since hyperlipidemia is a risk factor in cholelith formation, diet and lifestyle should be considerations in treating cholelithiasis (26). A link has been made in humans between inflammation and hyperlipidemia (27). Dietary and other changes to improve the gut microbiome should result in decreased systemic inflammation and may also contribute to a decrease in hyperlipidemia. Unfortunately, the owner declined to recheck blood chemistry profiles after the choleliths had been dissolved, so it is unknown if the hyperlipidemia had improved with the change in diet and supplementation.

Perhaps just changing to an evolutionarily appropriate diet may have decreased hyperlipidemia and led to decreased formation of choleliths. Fish was a protein recommendation made in the homemade diet for this dog, and the omega-3 fatty acid content could have had an effect, as fish oil has been shown to decrease hyperlipidema (20).

It seems counterintuitive that increasing the fat in the diet led to the dissolution of the choleliths, as a low-fat diet is the traditional treatment for choleliths and hyperlipidemia (28). However, it has been found that there is a link between higher serum insulin levels and hyperlipidemia, especially in Miniature Schnauzers with primary hyperlipidemia (29). When looking at the difference in macronutrient profiles between wild canid and kibble diets, protein content was similar (9, 10). The difference in macronutrients lies in the higher fat content in wild canid diets versus higher carbohydrate content in kibble-based diets (9). Increased carbohydrates in the diet would increase the serum carbohydrate levels, causing higher levels of insulin release, which correlates to the hyperlipidemia seen in Miniature

Schnauzers (29). A correlation between hyperinsulinemia and hyperlipidemia has also been found in diabetic dogs. A lower-glycemic index carbohydrate source in diabetic prescription diets, which should theoretically lower serum insulin levels, leads to lower cholesterol and triglyceride levels (30). Lower carbohydrate levels in the diet should lead to lower insulin levels and may correlate with lower lipid levels.

Supplement recommendations based on NRT may have contributed to the dissolution of the choleliths in the same way as the uroliths by addressing the underlying chemical toxicity. Niacin was added as niacinamide and could have decreased hyperlipidemia (20).

This author's experience supports that the dissolution of the cystoliths and the choleliths were a combination of changes to the base diet and the supplement regime discovered using NRT, with the base diet being the most important factor. If the base diet is not appropriate for the species, no supplementation can have the same effect on the microbiome. The goal of diet change and supplementation is not to treat the specific problem but to restore the body's normal physiological functioning and allow it to heal itself. The practitioner can use NRT to find what is interfering with normal physiological function and the modality of AK to find the correct nutrients to give the body what it needs.

This case illustrates both the benefits and limitations of NRT. Although this dog was never definitively diagnosed with cancer, she likely had cancer at the time of euthanasia. In this regard, two perspectives can be taken. The first is that her overall health was not better because the cancer was not detected and treated with NRT. It is essential to understand that NRT is not a modality for diagnosing or treating cancer or other diseases. The other view is that she experienced an improvement in her QOL in spite of having cancer. Improving the physiologic functioning of normal cells through proper nutrition often leads to increased QOL. Cancer cells are not normal functioning cells and therefore are difficult to change with food. The QOL of the patient is an important gauge of treatment success and a priority that veterinarians often discuss with clients (31). This author believes that the most important part of this case was that the owner reported increased QOL of her pet at every visit.

Owner compliance is sometimes cited as a reason for treatment failure (32). In the case reported here, there is good evidence for owner compliance. The owner picked up refills of medications and prescription diets at appropriate intervals and brought the dog in for recheck appointments and diagnostics at recommended intervals. However, she declined referral and surgery, stating financial reasons. Had the dog been referred, the next recommended step would have been removing the cystoliths with a minimally invasive procedure, like cystoscopy (5). However, this would have required anesthesia with inherent risks in a dog with documented liver disease. Interestingly, the owner's rate of declining diagnostic testing increased significantly as soon as her dog was feeling better. This likely indicates that the most important thing to this owner was the dog's QOL.

The pursuit of achieving owner compliance for the recommended treatment may be less relevant than finding the right treatment to get compliance within the limits and preferences of the household. Owners may have mental, emotional, and financial limitations to consider when creating a treatment plan. Occasionally, a belief system also plays into a treatment plan. Medical management may not have been the right modality for this pet. Likewise, NRT was the right modality for this dog, but not for every household or situation.

The use of AK is well-accepted in the chiropractic community. It is taught in many chiropractic schools in the United States. Although rarely used in veterinary medicine, this case shows that NRT can be an effective method for analyzing a patient's state of health and making recommendations to improve overall health and QOL.


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This author declares no conflicts of interest.


## Endnotes

a. Hill's Canine C/D Multicare, Hill's Pet Nutrition, Topeka, KS

b. Hill's Canine Low-fat I/D, Hill's Pet Nutrition, Topeka, KS

c. Royal Canin® S/O, Royal Canin USA, Inc, Saint Charles, MO

d. Clavamox® Drops, Zoetis, Parsippany, NJ

e. Orbax®, Merck, Darmstadt, Germany

f. Idexx 4Dx, Idexx, Westbrook, ME

g. Denamarin®, Nutramax, Lancaster, SC


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h. Detoxosode Chemicals, HVS Laboratories, Naples, FL

i. Arginex®, Standard Process, Palmyra, WI

j. Niacinamide-B6, Standard Process, Palmyra, WI

k. Multizyme®, Standard Process, Palmyra, WI

l. Phosfood® Liquid, Standard Process, Palmyra, WI

m. Livaplex®, Standard Process, Palmyra, WI

n. VF Bio-Dent®, Standard Process, Palmyra, WI

o. Zenequin®, Zoetis, Parsippany, NJ

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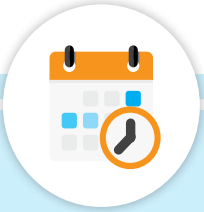

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