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MANAGEMENT OF STRUVITE UROLITHIASIS IN AN AMERICAN BULLY DOG

Penanganan Urolithiasis Struvit pada Anjing American Bully

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Abstract

Urolithiasis is one of the most common urinary tract disorders in dogs and can be influenced by nutritional factors, breed, sex, water intake, and infections caused by urease-producing bacteria. This article reports a 4-year-old female American Bully dog presenting with intermittent hematuria for eight months. Urinalysis revealed an alkaline urine pH of 8, urine specific gravity ≤ 1.010, and a very high number of struvite crystals. Ultrasonographic examination showed hyperechoic sand-like material within the urinary bladder, while no uroliths were detected on radiographic examination. Hematological and serum biochemical analyses revealed mild changes that remained within physiological limits. The therapeutic approach included administration of cefadroxil, methylprednisolone, Cystaid®, Nutri-Plus Gel®, and dietary modification to a therapeutic Urinary S/O for 14 days. Clinical and ultrasonographic evaluations after therapy demonstrated a reduction in the number of bladder crystals, along with improvement in urine color and odor. This case highlights that a combination of pharmacological therapy and dietary management plays an important role in the treatment of struvite urolithiasis in dogs, particularly cases associated with uncontrolled dietary patterns.

Keywords**:** dog, diet, urolithiasis, struvite

Abstrak

Urolithiasis merupakan salah satu gangguan saluran kemih yang umum pada anjing dan dapat dipengaruhi oleh faktor nutrisi, ras, jenis kelamin, konsumsi air, serta infeksi bakteri penghasil urease. Artikel ini melaporkan seekor anjing American Bully betina berumur 4 tahun dengan keluhan hematuria intermiten selama 8 bulan. Urinalisis menunjukkan pH urin 8, berat jenis ≤ 1.010, dan kristal struvit dalam jumlah sangat banyak. Pemeriksaan Ultrasonografi (USG)

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menunjukkan adanya pasir hiperekoik pada vesika urinaria tanpa terlihat urolith pada radiografi. Pemeriksaan hematologi dan biokimia darah menunjukkan beberapa perubahan ringan namun masih dalam batas fisiologis. Terapi yang diberikan meliputi Cefadroxil, Methylprednisolone, Cystaid®, Nutri-Plus Gel®, serta perubahan pakan menjadi Urinary S/O selama 14 hari. Evaluasi klinis dan USG pascaterapi menunjukkan penurunan jumlah kristal pada vesika urinaria serta perbaikan warna dan bau urin. Kasus ini menunjukkan bahwa kombinasi terapi farmakologis dan perubahan pakan berperan penting dalam penanganan urolithiasis struvit pada anjing, terutama yang dipicu oleh pola makan yang tidak terkontrol.

Keywords**:** anjing, pakan, urolithiasis, struvit

INTRODUCTION

Diet plays a crucial role in the quality of life of dogs. An imbalanced diet can lead to nutritional imbalances, which may predispose to conditions such as urolithiasis. Urolithiasis refers to the formation of uroliths or crystals in the urinary tract due to urine supersaturation (Sulistiawati *et al.*, 2022). This condition is a common urinary tract disorder in dogs (Hoxha & Rapti, 2018). Clinical signs of urolithiasis include dysuria, hematuria, stranguria, urinary bladder distension, and abdominal pain (Kimani *et al.*, 2021). However, a definitive diagnosis cannot be established based solely on history and clinical signs; supportive diagnostic examinations are required (Rana *et al.*, 2022).

Crystalluria is a clinical sign characterized by crystals in the urine observable via microscopy. Types of urinary crystals include struvite, calcium oxalate, uric acid, cystine, calcium carbonate, bilirubin, leucine, tyrosine, and ammonium urate (Sink & Feldman, 2004). The most frequently encountered crystals are calcium oxalate (46.3%) and magnesium ammonium phosphate (42.4%) (Men & Arjentin, 2018). Struvite crystals in dogs form due to supersaturation of magnesium, ammonium, and phosphate minerals in urine with a pH greater than 6.5 (Mariyani *et al.*, 2022). Struvite crystals appear as colorless, refractive, coffin-lid-shaped prisms composed of magnesium ammonium phosphate, with variations in prominence or darkness of the ends (Rizzi *et al.*, 2017). Factors influencing struvite crystal formation include breed, sex, diet, low water intake, and urease-producing bacteria (Hesse & Neiger, 2009).

If not expelled, urinary crystals may aggregate to form uroliths. Uroliths result from the amalgamation of numerous crystals (Rumapea *et al.*, 2023). Diet is key in managing canine urolithiasis. Dietary modification alone is often sufficient to prevent struvite formation within five to six weeks (Sturgess, 2009). Besides diet composition, feeding frequency is important as it affects mineral deposition in urine (Pitaloka *et al.*, 2025). Numerous commercial diets are currently designed to manage struvite urolithiasis. These diets are formulated to prevent struvite crystal or stone formation by acidifying urine, providing low magnesium levels, and containing restricted protein, thereby promoting crystal dissolution during urination.

RESEARCH METHODS

Signalement and Anamnesis

The case involved a 4-year-old intact female American Bully dog weighing 23.5 kg with a gray-white coat. The owner presented the dog to the Laboratory of Internal Medicine, Faculty of Veterinary Medicine, Udayana University, with a complaint of intermittent hematuria lasting eight months. The owner reported no signs of pain or difficulty during urination. The dog's urine was described as very pungent, cloudy yellow, and occasionally red. The dog was kept indoors but taken for walks to fields and beaches twice monthly. The owner frequently provided varied foods including always-available commercial dry food, chicken, rice, and

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occasionally fish, spaghetti, and pizza. Drinking water (mineral water) was always available. The dog had a good appetite but historically low water intake since puppyhood. Vaccination status was complete, with the last booster administered one year prior. The dog had not received recent anthelmintic treatment.

Physical Examination

The physical examination included assessment of body temperature, heart rate, pulse rate, respiratory rate, Capillary Refill Time (CRT), and skin turgor. Inspection, palpation, and auscultation were performed on all body systems, with particular focus on the urogenital system.

Laboratory Examination

Supportive examinations conducted included routine hematology, blood biochemistry, urinalysis, radiographic (X-ray) examination, and ultrasonography.

RESULTS AND DISCUSSION

Results

Findings from the vital signs examination were: body temperature 38.3°C, heart rate 112 bpm, pulse rate 96 bpm, respiratory rate 24 bpm, and CRT <2 seconds (Table 1). Physical examination revealed no abnormalities in the skin and nails, mucous membranes, circulatory, respiratory, digestive, urogenital, musculoskeletal, nervous, lymph nodes, ears, or eyes.

Further management involved laboratory examinations. Hematology results indicated leukopenia and granulocytopenia in the case animal (Table 2). Blood biochemistry showed mild elevations in total protein and globulin (Table 3). Urinalysis included macroscopic, microscopic, and chemical urine examination. Macroscopically, the urine was cloudy yellow, non-foamy, and very pungent. Microscopic examination was performed using native and sedimentation methods. Urine sediment revealed innumerable fragmented struvite crystals (Figure 2). Chemical urinalysis using a dipstick showed a pH of 8 and specific gravity ≤ 1.010. Results indicated elevated bilirubin, protein, specific gravity, and pH, along with the presence of ketones, nitrites, and leukocytes in the urine (Table 4). Radiographic interpretation revealed no stones along the urinary tract (Figure 3). Ultrasonographic examination identified hyperechoic granular material, indicating crystals within the urinary bladder (Figure 4).

Diagnosis dan Prognosis

Based on history, physical examination, and supportive diagnostic findings, the case dog was diagnosed with struvite urolithiasis with a *fausta* (favorable) prognosis.

Therapy

The dog in this study was managed with saline flushing and received causative, symptomatic, and supportive therapy. Causative therapy involved the antibiotic cefadroxil at a dose of 11 mg/kg BW PO every 12 hours for 7 days. Symptomatic therapy included methylprednisolone at 0.2 mg/kg BW PO every 12 hours for 5 days. Supportive therapy consisted of Cystaid® administered at 1 tablet every 12 hours for 14 days and Nutri-Plus® gel (Virbac, Carros, France) given as needed every 12 hours for 14 days. In addition to medication, the dog's diet was changed to Urinary S/O for 14 days.

Discussion

The owner reported intermittent hematuria in the case dog lasting eight months. Physical examination revealed no significant abnormalities. Results of routine hematology and blood

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biochemistry indicated leukopenia, granulocytopenia, and mild elevations in total protein and globulin. Microscopic urinalysis via native and sedimentation methods revealed a high quantity (innumerable) of fragmented struvite crystals. Struvite crystal formation is influenced by breed, sex, diet, low water intake, and urease-producing bacteria (Hesse & Neiger, 2009). When urine reaches a high saturation level, dissolved salts precipitate and form crystals (Amiruddin *et al.*, 2023). Struvite crystals are frequently associated with urease-producing bacteria that promote their formation, such as *Staphylococcus* spp. or *Proteus* spp. in dogs (Elliott *et al.*, 2017). Hematuria in urolithiasis can also be linked to bladder inflammation and trauma induced by struvite crystals (Ximenes *et al.*, 2023). The case dog is female, possessing a shorter urethra, a condition that increases susceptibility to urinary bladder infection (Ignat *et al.*, 2018). In this case, bacterial examination of the urine sediment was negative.

Struvite crystals are found in slightly acidic, neutral, or alkaline urine (Sink & Feldman, 2004). Chemical urinalysis using a dipstick revealed elevated bilirubin, protein, pH (8.5), and specific gravity (≤ 1.010), in addition to the presence of nitrites, ketones, and leukocytes in the urine. These findings are consistent with the statement by Sulistiawati *et al.* (2022) that struvite is found in alkaline urine. Ultrasonographic results indicated numerous fine sandy crystals within the urinary bladder; however, bladder wall thickness remained normal, and no stones were detected along the urinary tract. Hematuria in this case may have been caused by friction of urinary crystals against the vesical mucosa (Hutabarat *et al.*, 2024). Generally, struvite crystals are commonly found in healthy dogs, but when present in excessive quantities accompanied by clinical signs, they become problematic. In the presence of formed struvite crystals coupled with an uncontrolled diet, urolith formation is promoted.

Hematological examination indicated the case dog had leukopenia and granulocytopenia. Leukopenia can result from decreased bone marrow production or inflammation (Burton, 2024). Decreases in PCT and P-LCR indicate a reduced percentage of total platelet volume in the blood and a scarcity of mature platelets. Blood biochemistry was performed to assess renal function, given the eight-month duration of clinical signs. The mild elevations in total protein and globulin led to the conclusion that renal function remained adequate.

The administered treatment comprised causative, symptomatic, and supportive therapy. Causative therapy involved cefadroxil. Cefadroxil is a broad-spectrum, first-generation cephalosporin antibiotic whose mechanism of action involves inhibition of bacterial cell wall synthesis, leading to cell death (Papich, 2021). This antibiotic was used to prevent secondary infection due to the presence of vesical wall lesions, which facilitate bacterial entry and infection. Additionally, symptomatic therapy included the corticosteroid methylprednisolone as an anti-inflammatory agent (Plumb, 2008) following catheterization, intended to address urinary tract lesions caused by the crystals. Catheter placement for flushing aimed to cleanse the urinary bladder of obstructions and expel crystalline sediment deposits (Safitri *et al.*, 2025). Prior to catheter placement, liquid lubricant was applied, and the catheter was cleansed using an antiseptic (Thahir *et al.*, 2023).

Cystaid contains N-Acetyl-D-glucosamine, L-Theanine, and Quercetin, which function to maintain bladder wall integrity and possess anti-inflammatory properties to help preserve the bladder mucosa and avoid damage to bladder epithelial cells. Cystaid contains glucosamine, which supports the normal structure of the bladder lining, the glycosaminoglycan layer (Handoko *et al.*, 2023).

Diet plays a crucial role in urolith formation, as mineral components are derived from feed and the digestive process (Sulistiawati *et al.*, 2022). Beyond diet composition, factors related to feed as a major contributor to urinary crystal formation that require attention include feeding

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frequency, feeding method, feed type, and diet changes (Palestin *et al.*, 2022). Therefore, the provision of foods such as commercial dog food, pizza, spaghetti, and fish was discontinued, and the dog was switched to Urinary S/O, a diet formulated to prevent struvite crystal formation. This diet controls urine pH, is low in magnesium, and contains controlled protein levels for struvite management. Reported side effects include digestive disturbances such as diarrhea, vomiting, and constipation, but typically only during the transition period from a normal diet to the Urinary S/O diet (Diaz *et al.*, 2018). Increased water consumption is also necessary to prevent struvite crystal formation (Lailiyah *et al.*, 2022). Furthermore, diets with high plant-based protein content should be avoided (Mulyani *et al.*, 2024). Nutri-Plus® Gel is a multivitamin that functions as a supplement.

Evaluation was performed 14 days after initiating medication and dietary change. The case dog's urine was non-cloudy yellow and non-pungent. Follow-up ultrasonography showed that the crystals in the urinary bladder had decreased compared to the previous ultrasonographic findings. This indicates that the administration of medication and dietary modification had a positive impact on reducing struvite crystals, as well as improving urine color and odor.

A more comprehensive evaluation should have included repeat sedimentation and dipstick tests to confirm the quantity of struvite crystals and urine pH. However, as the owner did not consent to urine sampling via catheter, evaluation via urinalysis sedimentation and dipstick was not performed.

CONCLUSION AND ADVICE

Conclusion

Based on the history, physical examination, and supporting diagnostic results, a diagnosis of urolithiasis was made, with a favorable prognosis. Treatment consisting of cefadroxil, methylprednisolone, Cystaid®, Nutri-plus Gel®, and dietary modification to a urinary S/O formula yielded positive clinical outcomes. A follow-up evaluation 14 days post-therapy revealed a reduction in bladder crystalluria, yellow-colored urine, and the absence of pungent urine odor.

Advice

The owner was advised to continue feeding the urinary S/O diet for a period of five to ten weeks to minimize the recurrence of struvite crystalluria. Furthermore, it was recommended that the owner refrain from offering human food such as spaghetti and pizza. The nutritional requirements of the dog should be met solely with a complete and balanced commercial diet formulated for canine needs, accompanied by the provision of adequate fresh water.

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Tables

Table 1. Present Status Examination of the Animal

Examination	Result	Normal Value*)	Remarks
Temperature (°C)	38.3	37.5 – 38.6	Normal
Heart rate (kali/menit)	112	90 – 130	Normal
Pulse rate (kali/menit)	96	90 – 130	Normal
Respiration rate (kali/menit)	24	16 – 30	Normal
Capillary Refill Time (CRT)	< 2	< 2	Normal

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Table 2. Hematology Test Results

Parameter	Result	Normal Value*)	Remarks
WBC	3.32	6-17	Decreased
LYM#	2.05	0.8-5.1	Normal
MID#	0.2	0-1.8	Normal
GRA#	1.07	4-12.6	Decreased
LYM%	61.6	12-30	Increased
MID%	6.1	2-9	Normal
GRA%	32.3	60-83	Dicreased
RBC	6.15	5.5-8.5	Normal
HGB	16	11-19	Normal
MCHC	37.6	30-38	Normal
MCH	26	20-25	Increased
MCV	69.2	62-72	Normal
RDWCV	13.2	11-15.5	Normal
RDWSD	42	35-56	Normal
HCT	42.6	39-56	Normal
PLT	123	117-460	Normal
MPV	7.2	7-12.9	Normal
PDW	14.2	10-18	Normal
PCT	0.089	0.1-0.5	Decreased
P-LCR	7.7	13-43	Decreased

Table 3. Blood Chemistry Examination Results

Parameter	Result	Normal Value*)	Note
ALB	26.3	23.0 - 40.0	Normal
TP	84.8	49.0 - 82.0	Increased
GLOB	58.5	19.0 - 45.0	Increased
Crea	79.6	28.0 – 159.0	Normal
UA	31.41	0.00 – 60.00	Normal
BUN	4.86	2.50 – 9.60	Normal
BUN/CREA	60.970	16.000 – 218.000	Normal
TC	3.43	2.84 – 8.27	Normal
PHOS	1.17	0.81 – 2.19	Normal

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Table 4. Chemical Urinalysis Results

Parameter	Normal Value	Result	Note
Urobilinogen	-	16	Normal
Bilirubin	Small (16)	Large (100)	Abormal
Keton	-	Large (16)	Abnormal
Kreatinin	≤ 1.0	≤ 1.0	Normal
Blood	-	-	Normal
Protein	0.05 g/dL	≥ 20.0	Abnormal
Micro Albumin	10	10	Normal
Nitrite	- (Unreliable)	+	Abnormal
Leucocyte	- (Unreliable)	15	Abnormal
Glucose	-	-	Normal
Specific Gravity	< 1.015 - 1.040	≤ 1.010	Abnormal
pH	5-7.5	8.5	Abnormal
Ascorbate	0	0	Normal
Calcium	≤ 1.0	≤ 1.0	Normal

Figures

Figure 1. Hematuria found in this case study

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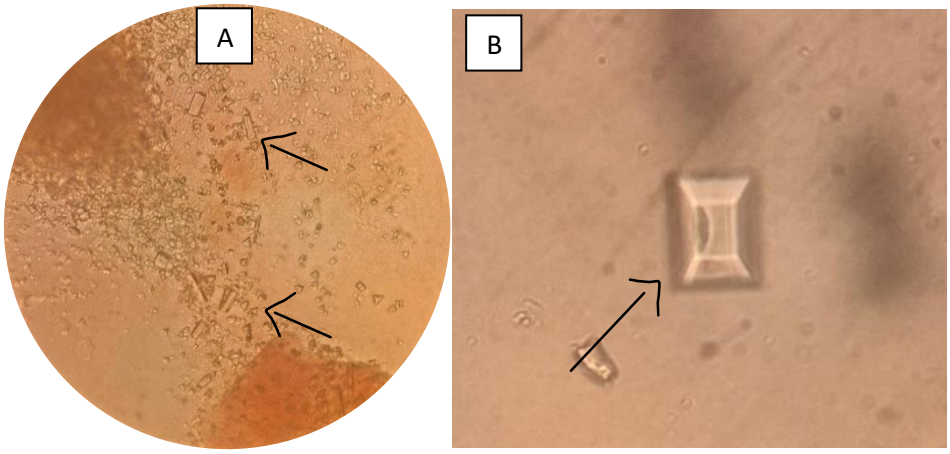

Figure 2. Struvite Crystals (black arrows) at 100x (A) and 1000x (B) magnification.

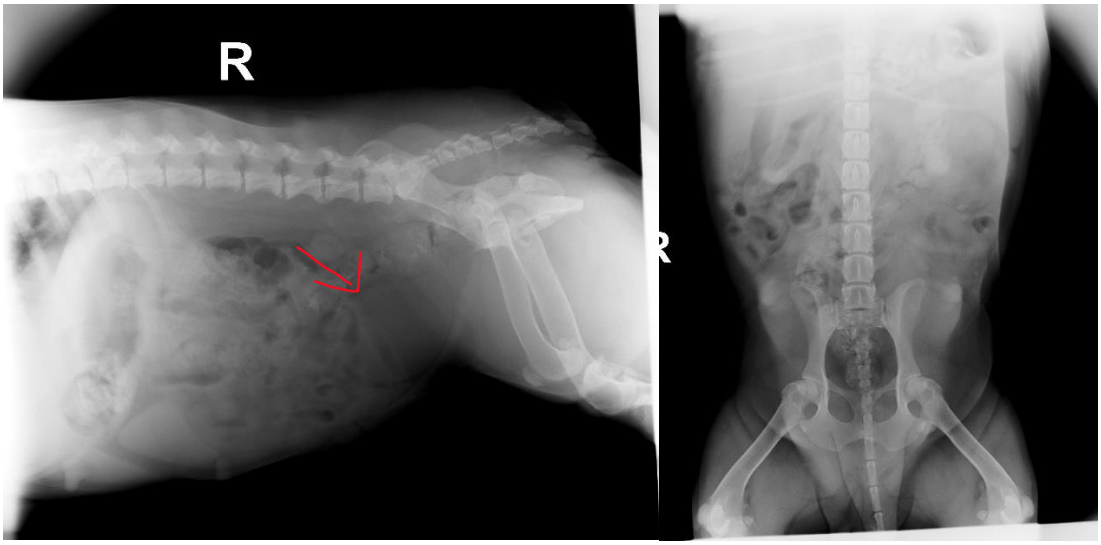

Figure 3. Radiographic (X-ray) result. No uroliths were detected.

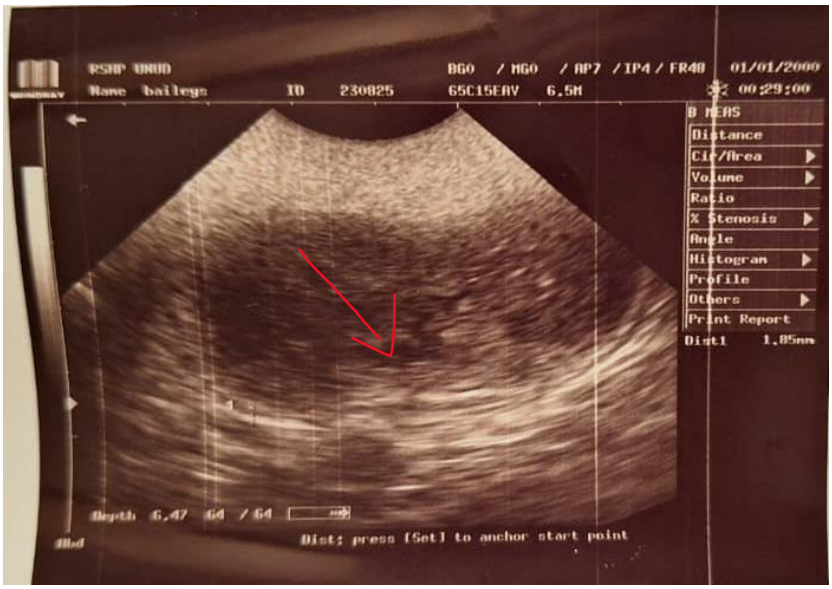

Figure 4. Ultrasonographic result. Hyperechoic crystalline sediment (grit) is present within the urinary bladder.

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