

USE OF CRANBERRY EXTRACT AS AN ALTERNATIVE THERAPY IN A CAT WITH UROLITHIASIS AND SINISTER UNILATERAL HYDRONEPHROSIS: A CASE REPORT

Laporan Kasus: Penggunaan Ekstrak Cranberry sebagai Terapi Alternatif pada Kucing dengan Urolithiasis dan Hidronefrosis Unilateral Sinister
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How to cite: Dewi NKP, Jayanti PD, Arjentina IPGY, Gunawan IWNF. 2026. Use of cranberry extract as an alternative therapy in a cat with urolithiasis and sinister unilateral hydronephrosis: a case report. *Bul. Vet. Udayana* 18(1): 42-54. DOI: <https://doi.org/10.24843/bulvet.2026.v18.i01.p05>

Abstract

Cranberry (*Vaccinium macrocarpon*) extract contains proanthocyanidins (PACs), anthocyanins, and flavonols, which act as antioxidants that protect kidney tissue through antioxidant activity and reduced oxidative stress and proinflammatory cytokine production. Urolithiasis is a urinary tract disorder characterized by the formation of crystals, excess sediment, uroliths, or calculi, which can block urine flow, causing back pressure on the kidneys and leading to hydronephrosis. This case report discusses the management of a 4-year-old domestic male cat that exhibited clinical symptoms of urinary tract obstruction and straining. Clinical signs of urinary tract obstruction were observed for one week. The diagnosis was made based on history, clinical signs, hematology, blood chemistry, urinalysis, and ultrasonography. Hematology examination results indicated lymphocytosis, granulocytopenia, and thrombocytopenia, while blood chemistry showed hypertotal proteinemia, hyperglobulinemia, and hypokalemia. Urine chemistry analysis showed positive leukocytes, protein, pH 7.5, specific gravity 1.010, and urine microscopy revealed struvite crystals and calcium oxalate. Ultrasonography revealed hyperechoic crystal particles in the lumen of the urinary bladder and dilated left renal pelvis. This case was diagnosed as urolithiasis and unilateral left hydronephrosis. Therapy included urinary catheter placement, 0.9% physiological NaCl flushing, 250 mg cranberry extract q24h PO, and special diet for kidney problems. Evaluation showed clinical improvement marked by the absence of stranguria and oliguria, although urinary crystals and dilated left renal pelvis were still detected on ultrasound examination. The owner was advised to monitor the urinary tract through urinalysis and ultrasound periodically, implement a special diet for kidneys and adequate water intake.

Keywords: Urolithiasis, hydronephrosis, cranberry extract, ultrasound

Abstrak

Ekstrak cranberry (*Vaccinium macrocarpon*) mengandung proanthocyanidins (PACs), antosianin dan flavonol berperan sebagai antioksidan yang melindungi jaringan ginjal melalui aktivitas antioksidan dan penurunan stres oksidatif serta produksi sitokin proinflamasi. Urolithiasis adalah gangguan pada saluran kemih yang ditandai dengan terbentuknya kristal, endapan berlebih, urolit, atau kalkuli, yang dapat menyumbat aliran urine sehingga menimbulkan tekanan balik ke ginjal dan berujung pada terjadinya hidronefrosis. Laporan kasus ini membahas penanganan seekor kucing jantan domestik berusia 4 tahun yang menunjukkan gejala klinis berupa susah berkemih dan mengejan saat berkemih. Tanda klinis dari gangguan perkemihan diamati dari satu minggu. Diagnosis ditegakkan berdasarkan anamnesis, tanda klinis, hematologi, kimia darah, urinalisis, dan ultrasonografi. Hasil pemeriksaan hematologi mengindikasikan limfositosis, granulositopenia, dan trombositopenia, sedangkan kimia darah menunjukkan hipertotalproteinemia, hiperglobulinemia, dan hipokalemia. Hasil urinalisis kimia urin menunjukkan positif leukosit, protein, pH 7,5, berat jenis 1.010 dan hasil mikroskopis urin ditemukan kristal struvit dan kalsium oksalat. Ultrasonografi memperlihatkan partikel kristal hyperechoic di lumen vesika urinaria dan dilatasi pelvis renal sinister. Kasus ini didiagnosis sebagai urolithiasis dan hidronefrosis unilateral sinister. Terapi meliputi pemasangan kateter urin, flushing NaCl fisiologis 0,9%, ekstrak cranberry 250 mg q24h PO, dan diet makanan khusus permasalahan ginjal. Evaluasi menunjukkan perbaikan klinis yang ditandai dengan tidak menunjukkan stranguria dan oliguria, meskipun kristal urin dan dilatasi pelvis ginjal kiri masih terdeteksi pada pemeriksaan ultrasonografi. Pemilik disarankan untuk melakukan monitoring saluran kemih melalui pemeriksaan urinalisis dan ultrasonografi secara berkala menerapkan diet pakan khusus untuk ginjal dan asupan air yang cukup.

Kata kunci: Urolithiasis, hidronefrosis, ekstrak cranberry, ultrasonografi

INTRODUCTION

Cranberry (*Vaccinium macrocarpon*) is a fruit rich in bioactive compounds, particularly polyphenols such as flavonoids, anthocyanins, and proanthocyanidins (PACs). Cranberries are widely known for their antioxidant activity, which plays a role in reducing oxidative stress and inflammation associated with kidney and urinary tract health. Therefore, cranberries have potential not only as an adjunct therapy in preventing urinary tract infections but also as a functional food to maintain overall urinary tract health (Nemzer et al., 2022). In research conducted by Prasad et al. (2025) showed that administration of cranberry (*Vaccinium macrocarpon*) fruit extract had a protective effect on kidneys experiencing ischemia/reperfusion injury, showing significant improvements in kidney function parameters, characterized by decreased levels of serum creatinine, urea, and biomarkers of oxidative stress. Cranberry also has the potential to provide protection against bacterial adhesion in the urinary tract of cats and is effective in reducing the symptoms of feline idiopathic cystitis (Kim et al., 2011); Carvajal-Campos et al., 2024).

Urolithiasis is a urinary tract problem characterized by the formation of stones (uroliths) in the kidneys, ureters, bladder, and urethra. This condition is quite common in both dogs and cats (Polat & Sagliyan, 2022). The process of urolith formation occurs when urine contains excessive amounts of lithogenic substances, triggering precipitation and obstructing urine flow. Factors that play a role in urolith formation include increased concentrations of certain minerals (calcium, sodium, oxalate, magnesium, and others), changes in urine acidity (pH),

inflammation in the urinary tract, and low urine volume, which can trigger crystal precipitation, ultimately leading to the formation of uroliths (Widodo et al., 2023; Berutu et al., 2024). Urolithiasis causes clinical symptoms such as stranguria, hematuria, abnormal voiding posture, and dysuria when urethral obstruction occurs (Polat & Sagliyan, 2022). Obstruction in the urinary tract triggers back pressure on the kidneys, resulting in hydronephrosis (Vertloo, 2025).

The occurrence of hydronephrosis in cats is one of the findings of kidney disorders in veterinary practice (Abdel-Saeed et al., 2021). According to Remichi et al. (2020), 9.37% of 32 cats with urolithiasis had hydronephrosis. Hydronephrosis is a dilation of the renal pelvis and renal calyces due to urinary tract obstruction at the renal or postrenal level, which causes progressive atrophy of the renal parenchyma. In cats, hydronephrosis is caused by obstruction of the ureter or urethra due to uroliths in the urinary tract, inflammation, or neoplasia (Kim et al., 2021). Hydronephrosis is divided into two types: unilateral and bilateral. Unilateral cases often lack obvious clinical symptoms, making them difficult to recognize. Obstruction can impede the normal flow of urine, causing kidney swelling (Selgas et al., 2014).

The diagnosis of urolithiasis and hydronephrosis requires a thorough history, physical examination, and supporting tests. This article aims to assess the effectiveness of cranberry extract in cats with urolithiasis and mild hydronephrosis.

RESEARCH METHODS

Signalment and Anamnesis

The case animal is a 4-year-old male domestic cat, weighing 4.5 kg and having orange fur. The cat complained of difficulty urinating and frequent straining when urinating. The cat frequently urinated indiscriminately, had a strong urine odor, and was observed licking its genital area. According to the owner, these symptoms had only been observed for the past week. There was no history of any other illnesses in the cat. The cat had never received any treatment, including vaccinations or deworming. The cat was kept free-range in the home environment (not caged). The cat's primary diet consisted of salted fish and rice, dry food, and was rarely given drinking water.

Physical and Clinical Examination

Physical and clinical examinations were conducted using inspection, palpation, auscultation, olfaction, and counting methods on 22 May 2025 to assess the animals' overall health. The examination procedures included a general examination, including observations of their physical condition, behavior, and responses to stimuli.

Laboratory Examination

Urinalysis

Laboratory examinations included macroscopic, microscopic, and chemical urine analysis. Urine samples were collected via catheterization in the case cats and collected in sterile urine containers. Macroscopic examination included urine color, viscosity, clarity, and odor. Chemical analysis was performed using a urine dipstick by dipping the strip into the urine sample, then comparing the results with normal urine parameters. Microscopic examination was performed by centrifuging the urine for 5 minutes at 1500 rpm. The supernatant was discarded until a sediment remained, which was then collected using a 1 cc syringe without a needle, dropped onto a glass slide, covered with a coverslip, and observed under a microscope.

Blood Chemistry

The cat's blood sample was collected using venipuncture, a medical technique involving puncturing a vein using a sterile syringe to draw blood from the cephalic vein using a 3cc syringe and placing it in a serum separator tube. The sample was left for several minutes and then centrifuged to obtain blood serum blood chemistry using the IDEXX Catalyst One® machine.

Complete Blood Count (CBC)

The blood sample of the case cat was taken using the venipuncture technique on the cephalic vein using a 3cc syringe, after the blood was taken it was put into an EDTA (Ethylenediaminetetraacetic acid) tube, then examined using the CBC RT-7600 For Vet machine.

Ultrasonography (USG)

Ultrasonography was performed by placing the transducer on the shaved abdomen of the cat, which was treated with ultrasonic gel to minimize interference with sound wave transmission. The kidneys, ureters, urinary bladder, and urethra were evaluated. The kidneys were examined by placing the transducer on the left and right sides of the abdomen to assess their size, morphology, cortical and medullary structure, and the condition of the renal pelvis. The bladder was also examined while the bladder was filled with urine to ensure the bladder wall was clearly visible, allowing for assessment of size, shape, and wall thickness, as well as identification of uroliths, sediment, or abnormal masses.

RESULTS AND DISCUSSION

Results

Physical and Clinical Examination

The cat's praesens status indicated a generally good condition, as shown in Table 1. However, the cat's temperament tended to be quieter with a hunched posture. On inspection, the genital mucosa appeared reddish, the hair around the genitals was wet with urine, and the urine had a strong odor with a cloudy brownish-yellow color. Palpation revealed the left kidney was more caudal and did not move normally, and there was distention of the urinary bladder.

Laboratory Examination

Urinalysis

Physical examination showed that the urine appeared brownish yellow, cloudy, had a strong odor, was slightly foamy, and contained sediment before centrifugation, as seen in (Figure 1). Microscopic examination showed the presence of magnesium ammonium phosphate (struvite) and calcium oxalate crystals, as seen in (Figure 2). Chemically, the urine showed positive leukocytes and protein, with a pH of 7.5 and a specific gravity of 1.010. Other parameters such as nitrite, urobilinogen, blood, ketones, bilirubin, glucose, calcium, microalbumin, and creatinine showed negative results.

Blood Chemistry and Complete Blood Count Test

Routine hematology tests indicated lymphocytosis, granulocytopenia, and thrombocytopenia, as shown in Table 2. Blood chemistry tests indicated hypertotal proteinemia, hyperglobulinemia, and hypokalemia, as shown in Table 3.

Ultrasonography Examination

Ultrasonography examination revealed the presence of hyperechoic urinary crystal particles in the lumen of the urinary bladder. Imaging of the left kidney showed a size of 4.37 cm and a dilation of the left renal pelvis measuring 0.70 cm. Imaging of the right kidney showed a kidney size of 4.13 cm and a pelvis size of 0.21 cm. These results indicate abnormalities in the urinary bladder in the form of crystal particle deposits and dilation of the left renal pelvis, as can be seen in Figure 3.

Diagnosis

Based on anamnesis, clinical symptoms, clinical examination and confirmed by laboratory examination, it can be concluded that the case cat was diagnosed with urolithiasis and unilateral hydronephrosis with a dubious prognosis.

Therapy

Treatment involves inserting a 3½-Fr urinary catheter and flushing with 0.9% physiological saline. The catheter is placed for 3 days as the initial treatment for cats with obstructive urolithiasis. This is an initial stabilization measure aimed at reopening the urinary tract, reducing intravesical pressure, and restoring renal excretory function (Taylor et al., 2025). Alternative therapy with 250 mg of cranberry extract orally once daily for fourteen days and a special diet from Royal Canin Early Renal[®], PT. Royal Canin Indonesia, Surabaya, Indonesia, was given as supportive therapy. This diet is specially formulated for cats in the early stages of chronic kidney disease and contains low phosphorus and omega-3 fatty acids (EPA and DHA).

Discussion

Urolithiasis is a condition caused by the presence of crystals, excess sediment, uroliths (stones), or calculi in the urinary tract. The mineral mass is generally composed of one or more types of minerals, such as struvite, calcium oxalate, calcium phosphate, uric acid, or cystine in the urine (Riesta & Batan, 2020; Ximenes et al., 2023). While hydronephrosis is defined as dilation of the renal pelvis caused by obstruction of urine flow from the kidney, resulting in progressive atrophy of the renal parenchyma and evidence of loss of normal structure (Bruyère, 2013; Abdel-Saeed et al., 2021). Another disorder can be caused by vesicoureteral reflux, which is the backflow of urine from the bladder to the kidneys. In this case, it occurs in one kidney, the left, and is characterized by dilation of the renal pelvicolalyceal system (Hospital et al., 2012). Clinical symptoms of urolithiasis and hydronephrosis in cats include stranguria, pollakiuria, and painful bladder distension on palpation (Riesta & Batan, 2020; Singh et al., 2025). Abdominal palpation revealed a distended, full, and painful bladder. The distal penis appeared dark red, and there was urine residue on the wet hair around the genital area (Boelter & Seshadri, 2023).

The urinalysis results for the cat showed urine that was brownish-yellow or dark yellow, cloudy, had a strong odor, and contained sediment. The darker yellow color than normal is caused by urochrome, a combination of urobilin and urobilinogen with peptides (Yadav et al., 2020). The chemical urinalysis results showed positive results for leukocytes and protein, a pH of 7.5, and a specific gravity of 1.010. An increase in leukocytes in the urine indicates an inflammatory process in the urinary tract. Furthermore, an increase in leukocytes in the urine test is associated with proteinuria. Proteinuria can occur due to prerenal, renal, or postrenal mechanisms and generally indicates impaired glomerular filtration, which increases permeability, allowing protein to pass through and be excreted in the urine (Yadav et al., 2020). Urolithiasis and urethral plugs can cause irritation and inflammation of the urinary bladder,

thus triggering an increase in globulin or protein leakage into the urine (Islamiati et al., 2024). According to Willard and Tvedten (2012) in Islamiati et al., (2024), the increase in the number of leukocytes can be caused by inflammation, infection, or trauma caused by crystals. Alkaline urine pH conditions support the formation of struvite crystals, because magnesium, phosphate, and ammonium ions precipitate more easily and form crystals at alkaline pH. According to Stockhom and Scot (2002) in Men & Arjentinia (2018), Urine pH is an important indicator in assessing urinary tract conditions and the potential for urolith formation. At pH >7, crystals tend to form, including calcium carbonate, calcium phosphate, and struvite, and this condition can indicate liver disease or early kidney dysfunction. Conversely, a pH <7 more often triggers the formation of calcium oxalate, cystine, urate, and xanthine.

Routine hematology tests revealed lymphocytosis, granulocytopenia, and thrombocytopenia. Lymphocytosis indicates an increase in lymphocytes in response to a chronic inflammatory process (Kurnianto et al., 2023). Granulocytopenia is associated with a decrease in granulocytes that is common in hematopoietic dysfunction and immune disorders in cats with Chronic Kidney Disease (Žel et al., 2024). Disorders of blood cell formation in the bone marrow can occur due to chronic uremia, immune changes, and the effects of chronic inflammation. Thrombocytopenia can occur due to local bleeding, acute inflammation, or kidney disorders that trigger increased platelet consumption, resulting in decreased platelet count (Javinsky, 2012). Blood chemistry results showed hyperproteinemia, in cats with urinary tract disorders generally caused by hemoconcentration due to dehydration and a systemic inflammatory response, characterized by an increase in acute-phase proteins such as serum amyloid A, alpha-1-acid glycoprotein, and fibrinogen, and a decrease in albumin, as reported in cases of obstructive feline lower urinary tract disease (Dinallo et al., 2022). In addition, increased urinary tract infections can trigger an immune response that causes an increase in the amount of globulin in the blood, resulting in hyperglobulinemia (Gunn-Moore, 2003; Mayer-Roenne et al., 2007). Hypokalemia in cats with urinary tract disorders such as urethral obstruction is generally caused by post-obstructive diuresis, which is increased urine output that carries potassium out of the body, especially if the cat is dehydrated or metabolic acidosis. Increased urinary potassium excretion is due to renal tubular dysfunction and acid-base imbalance (Francis et al., 2010; Fröhlich et al., 2016).

Ultrasonographic examination of a cat with urolithiasis revealed hyperechoic particles floating in the urinary bladder, indicating the presence of crystals (Faradina et al., 2023; Berutu et al., 2024). On kidney examination, the sagittal view of the left kidney showed a length of 4.37 cm and a width of 2.89 cm, while the dorsal view of the right kidney showed a length of 4.13 cm and a width of 2.52 cm. The standard size of a normal cat kidney is 3.2–4.1 cm in length and 2.2–2.8 cm in width, so the patient's kidney size is slightly abnormal in terms of kidney length (Mattoon et al., 2020). In addition, dilation of the left renal pelvis measuring 7 mm was observed. Renal pelvic dilation is a sign of hydronephrosis, a pathological condition characterized by distension and widening of the kidneys, which can occur unilaterally or bilaterally due to obstruction of urine flow in distal parts such as the ureter, bladder, or urethra (Wibowo et al., 2025). Renal pelvis size above 3 mm indicates hydronephrosis (Debruyne et al., 2012). Pelvic dilation measuring 7 mm is considered mild, evaluated from clinical symptoms of sanguuria and ultrasonography results that show no progressive atrophy of the renal parenchyma and loss of normal structure (D'Anjou et al., 2011). Dilation of the renal pelvis due to obstruction leads to increased intrarenal pressure, leading to fluid accumulation in the pelvicalyceal system. Unilateral hydronephrosis often presents no obvious symptoms in the early stages because the contralateral kidney is still able to compensate for its excretory

function. Clinical manifestations only appear when the damage progresses, characterized by polyuria, polydipsia, anorexia, weight loss, or abdominal pain (Abdel-Saeed et al., 2021).

Treatment of urolithiasis accompanied by unilateral left hydronephrosis includes catheter placement, therapy with cranberry extract, and a special renal diet. Cranberry (*Vaccinium macrocarpon*) is a fruit rich in bioactive compounds, especially A-type proanthocyanidins (PACs), flavonoids, anthocyanins, phenolic acids, vitamins C and E. The content of A-type proanthocyanidins (PACs) can prevent urinary tract infections by inhibiting the adhesion of *Escherichia coli* bacteria to the uroepithelial epithelium, thereby reducing the risk of colonization and recurrence of infection (Jangid et al., 2025). In addition, anthocyanins and flavonols act as antioxidants that protect kidney tissue from damage caused by free radicals (Colombino et al., 2022). Triterpenoids, particularly ursolic acid and oleanolic acid, also contribute to preventing fibrosis, which can damage kidney function. Meanwhile, vitamins C and E can enhance antioxidant defenses, maintain urine pH to prevent bacterial growth, and protect kidney cells from oxidative damage. Minerals such as potassium help maintain fluid balance and kidney filtration function, while complex oligosaccharides such as xyloglucan and pectin can be absorbed in the digestive tract and then filtered by the kidneys to help reduce urinary tract inflammation (Carvajal-Campos et al., 2024). With this combination of mechanisms, cranberries are not only effective in preventing urinary tract infections, but also have the potential to protect the kidneys from long-term damage (Nemzer et al., 2022) in research conducted by Mohammed & Al-Shawi (2023). Cranberry extract has a nephroprotective effect, as evidenced by a decrease in serum creatinine levels, an increase in renal GSH, and an improvement in histopathological damage in cisplatin-induced rats.

Post-therapy with cranberry extract, the cat showed clinical improvement. However, there were no significant changes in urinalysis or ultrasound of the urinary bladder and kidneys. This condition is thought to be related to the pharmacokinetic and pharmacodynamic properties of the bioactive compounds in cranberries, which require regular and continuous administration to achieve optimal effects. Herbal therapies generally work more slowly than synthetic drugs due to their complex compounds, low bioavailability, and slower absorption, metabolism, and distribution. Therefore, therapeutic effects are only apparent after long-term use (Zhang et al., 2022). Colombino et al. (2022) stated that administering cranberry extract to cats with urinary tract disorders showed improvement in symptoms after 60 days of routine therapy.

CONCLUSION AND SUGGESTION

Conclusion

Therapy with cranberry extract managed to address clinical symptoms in a cat diagnosed with urolithiasis and unilateral hydronephrosis, characterized by the absence of stranguria and oliguria. However, urinalysis and ultrasound results showed no significant improvement, necessitating further therapy with cranberry extract.

Suggestion

The owner of the cat in question is advised to continue therapy with cranberry extract for 46 days and to monitor the health of the kidneys and urinary tract through regular urinalysis and ultrasound examinations, and to implement a special diet low in protein and minerals with sufficient water intake.

ACKNOWLEDGEMENT

The author expresses his deepest gratitude to God Almighty for the smooth writing of this case study. He also thanks the entire staff of the Veterinary Internal Medicine Laboratory, Faculty

of Veterinary Medicine, Udayana University, for all the assistance, facilities, and guidance provided during the completion of this case study.

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Tables

Table 1. Present Status of The Cat Used in This Case Study

No.	Type of Examination	Results	Normal Values	Information
1.	Heart rate (x/min)	132	76-180	Normal
2.	Pulse (x/minute)	132	76-180	Normal
3.	Capillary refill time/CRT (seconds)	<2	<2 seconds	Normal
4.	Respiration (times/minute)	32	24-42	Normal
5.	Temperature (°C)	38.6°C	37.8-39.2°C	Normal

Table 2. Complete Blood Count Test Results

Test	Results	Parameter	Information
WBC	11 x 10 ³ /uL	5.5-19.5	Normal
LYM	10.18 x 10 ³ /uL	0.8-7	High
MID	0.34 x 10 ³ /uL	0-1.9	Normal
GRA	0.48 x 10 ³ /uL	2.1-15	Low
LYM%	92.6%	12-45	High
MID%	3.1%	2-9	Normal
GRA%	4.3%	35-85	Low
RBC	6.58 x 10 ⁶ /uL	4.6-10	Normal
HGB	13.2 g/dL	9.3-15.3	Normal
MCHC	31 g/dL	30-38	Normal
MCH	20 pg	13-21	Normal
MCV	64.6 fL	39-52	High
RDWCV	12.7%	14-18	Low
RDWSD	39.4 fL	35-56	Normal
HCT	42.4%	28-49	Normal
PLT	70 x 10 ³ /uL	100-514	Low
MPV	7.9 fL	5-11.8	Normal
PDW	5.7 fL	10-18	Low
PCT	0.055%	0.1-0.5	Low
P-LCR	21.2%	13-43	Normal

Table 3. Blood Chemistry Test Results

Test	Result	Reference Interval
GLU	6.40 mmol/L	4.11-8.84
CREA	77 μ mol/L	71-212
UREA	10.7 mmol/L	5.7-12.9
BUN/CREAM	34	
TP	97 g/L	57-89
ALB	29 g/L	22-40
GLOB	68 g/L	28-51
ALB/GLOB	0.4	
ALT	114 U/L	12-130
ALKP	<10 U/L	14-111

Figures



Figure 1. Macroscopic examination of urine contains sediment shown by the blue arrow (left) and foam in the urine shown by the red arrow (right)

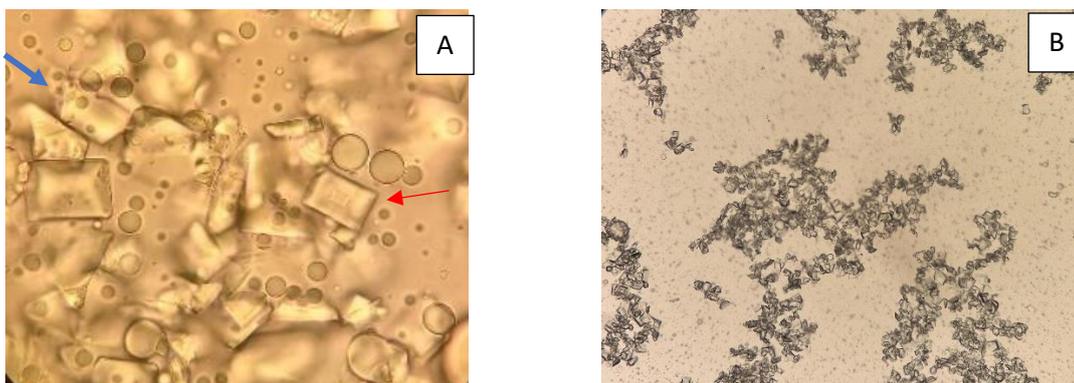


Figure 2. Urine sedimentation examination shows the presence of struvite crystals indicated by the blue arrow and calcium oxalate indicated by the red arrow (A: 1000X magnification) (B: 100X magnification)

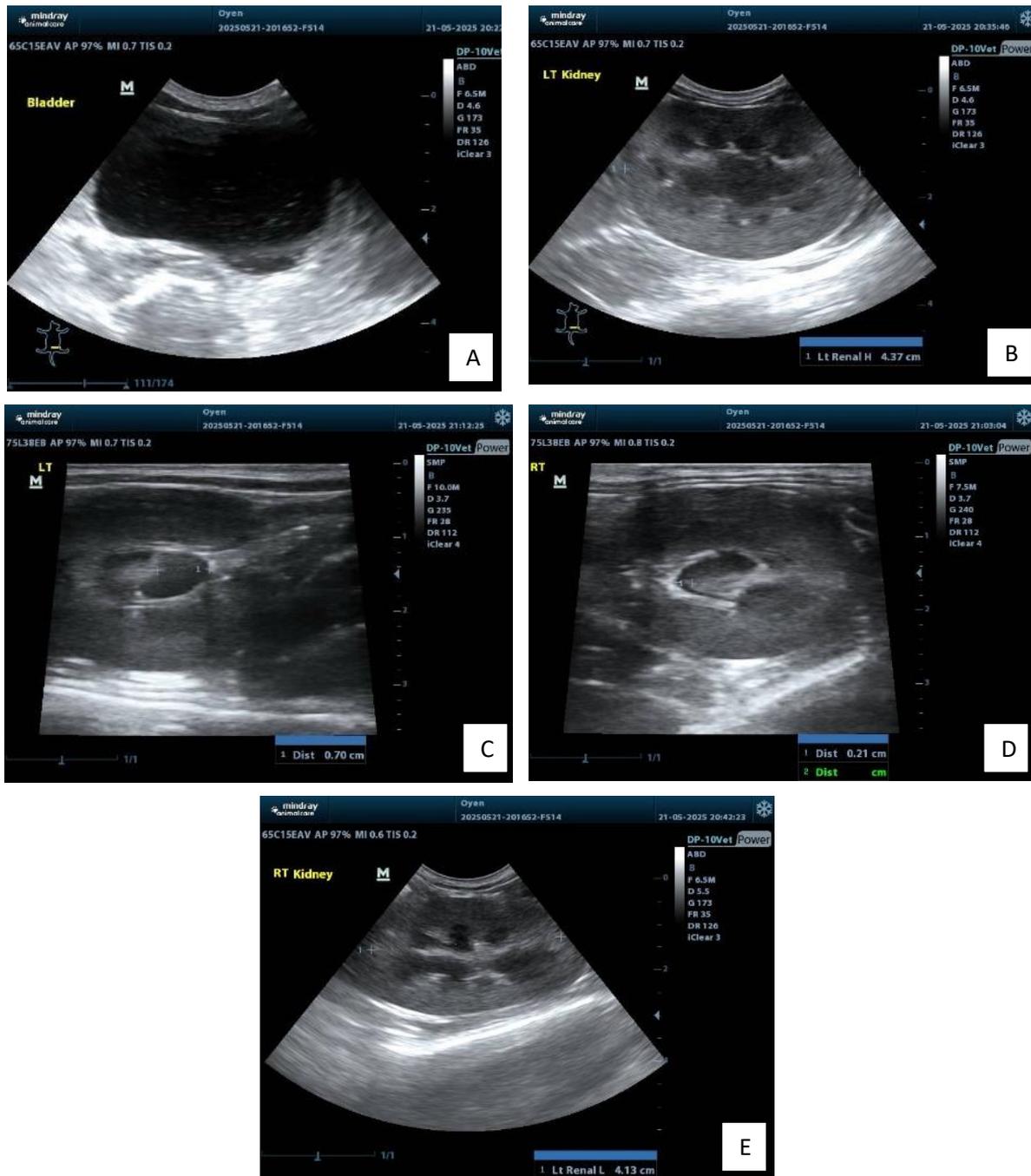


Figure 3. Ultrasound results. (A) Vesica urinaria of the cat shows a hyperechoic silhouette (crystal) of the bladder, (B) The left kidney with a length of 4.37 cm and a width of 2.89 indicates a slight enlargement of the left kidney, (C) The pelvis appears to be dilated with a size of 0.70 cm, (D) The right kidney with a length of 4.13 cm and a width of 2.52 is still within normal limits, (E) The left renal pelvis with a size of 0.21 cm is considered normal.