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Case Report: Diagnosis and treatment of non-infectious cystitis in domestic cats at the Hasanuddin University Veterinary Teaching Hospital, Makassar

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Abstract

Feline Lower Urinary Tract Disease (FLUTD) is a term used to describe a condition that can affect the urinary bladder and lower urinary tract. Cystitis is an inflammatory disease of the urinary bladder caused by infectious and non-infectious agents, namely urine crystals. The occurrence of crystals in the urinary tract often occurs in cats that consume high-mineral and calcium feed without adequate water intake. The cat case complained of not urinating for three days, abdominal distension, and pain in the urinary bladder. Examination methods with routine hematology, ultrasonography, native tests, urine dipsticks, bacterial cultures, and native tests were carried out at the Unhas Veterinary Teaching Hospital. The diagnosis of Cystitis was confirmed by laboratory examination results found struvite crystals found >10 crystals/HPF, ultrasound examination showed hyperechoic appearance in the urinary bladder, urine dipstick test pH 7.5 and protein +++, hematology results found an increase in MCV values and a decrease in Hb, MCHC and PCT indicators. . Handling of this case with catheter installation and fluid therapy. Treatment with antibiotics, anti-inflammatories, and supportive drugs vitamins and immune boosters. Also given a diet feed to prevent recurrence of the case.

Keywords: *Cystitis, FLUTD, ammonium urate, Cats*

Introduction

Feline Lower Urinary Tract Disease (FLUTD) in cats is a term used to describe a condition that can affect the cat's urinary bladder and lower urinary tract (Azhar et al., 2022). In male cats, this condition is caused by an anatomical structure that is shaped like a tube with a narrowed part so that urine can be blocked (Riesta and I Wayan, 2020). Clinical signs of FLUTD that can be found include bloody urination (hematuria), pain during urination (dysuria) accompanied by decreased urinary frequency (oligouria), or obstruction of the

urethra (stranguria) (Kurnianto et al., 2023). This condition occurs due to dysfunction of both the urinary system and the cat's urethra. FLUTD can occur due to several factors, for example feline idiopathic, interstitial cystitis, urolithiasis, and bacterial infections (Azhar et al., 2022).

Cystitis is an inflammatory disease of the urinary bladder caused by infectious and non-infectious agents that result in hemorrhage of the urinary bladder mucosa. Common clinical signs of FLUTD will be seen as dysuria, stranguria, hematuria, and abdominal pain. Also accompanied by depression, weakness, vomiting, decreased appetite, and can be found with infection. Generally, dysuria and stranguria will be experienced by cats diagnosed with Cystitis. Distension in the abdomen, specifically in the urinary bladder, will correlate with the occurrence of dysuria and stranguria. This condition is caused by obstruction of the urethra by debris, plugs, or crystals (Paramita et al., 2021).

The occurrence of crystals in the urinary tract often occurs in cats that consume high-mineral and calcium feed without adequate water intake (Mihardi et al., 2019). Improper diet and composition can cause nutritional imbalances in the cat's body, thus affecting urine acidity (pH), urine volume, and urine concentration which can trigger the formation of excess minerals in the urine (Riesta and I Wayan, 2020). In addition, it can be supported by other factors such as frequency of urination, genetics, and the presence of urinary tract infections of proteolytic bacteria. These bacteria are able to produce protease enzymes that produce urease which can cause the formation of urolith crystals (Ahmed et al., 2018).

Urolith crystals can be divided into four, namely struvite (ammonium magnesium phosphate), urate (ammonium urate, sodium urate, and uric acid), cystine, and calcium (calcium oxalate and calcium phosphate). The crystals that are often found in cases of Cystitis are calcium oxalate with a percentage of 46.3%. Then, in second place is struvite with a percentage of 42.4% (Riesta and I Wayan, 2020).

Diagnosis for urinary tract cases includes gender and age signalement to determine the composition of uroliths, clinical symptoms, abdominal palpation to find the presence or absence of cystic calculi, and rectal examination (Riesta and I Wayan, 2020). Accompanied by further examinations such as hematology, ultrasonography, urinalysis, and bacterial culture. Treatment with catheterization can be implemented to overcome obstruction that occurs in the urinary tract (Paramita et al., 2022).livestock production and productivity levels so as not to cause losses for farmers.

Materials and Methods

Sinyalemen

A domestic short-haired cat named Abon was examined at the Veterinary Teaching Hospital (RSHP) of Hasanuddin University, Makassar. The cat is male with white, black, and gray hair. He is 3 years old and weighs 3.9 kg.

Figure 1. Patient

Anamnesis

The patient who was examined came with a complaint of not urinating for 3 days. Abon often strained in the litter box, but no urine came out. There was an enlargement of the abdomen in the hypogatricus area. Eating and drinking normally three times a day with commercial dry food (Cat Choice). The cat had not been vaccinated and had not been dewormed, and the patient was an indoor and outdoor cat

Laboratory Examination

In order to help establish a diagnosis of the patient, further examinations were carried out in the form of routine hematology by taking blood samples from the cat and then putting them into an EDTA (ethylene diamine tetraacetic acid) tube to be tested on the Hematology Analyzer. USG (ultrasonography), urine native test, and urine dipstick test were also performed. Bacterial culture was also performed by taking urine samples from the cat to see if there was a bacterial infection.

Diagnosis and Prognosis

The patient was diagnosed with Cystitis. The diagnosis was confirmed based on clinical signs, hematology, and the results of further examination with ultrasonography (USG). All examinations were carried out at the Hasanuddin University Veterinary Teaching Hospital. The prognosis for this case is fausta because the patient is still in a fairly stable condition and can be treated with catheter installation and appropriate medical therapy. After 7 days the patient showed progress with urine that returned to normal color, namely light yellow. Therapy.

Table 1. Dose calculation for patient therapy

Drug	Recommended Dosage	Dosage	Duration of Drug Administration
Intramox-150®	0,1 ml/kg	0,1 ml x 3,9 = 0,39 ml	6 days
Glucortine-20®	0,5 ml	0,5 ml	5 days
Curcuma Plus Appetite®	0,5 – 1,0 ml	0,5 ml	7 days
Imboost Kids®	0,5 – 1,0 ml	0,5 ml	7 days

In this case, treatment was performed by inserting a catheter into the patient's urinary tract. The catheter was inserted to help remove urine that had previously been unable to pass. Fluid therapy (Ringer Lactate®, PT. Widatra Bhakti, East Java, Indonesia) intravenously for three days. The treatment given was a penicillin antibiotic, namely amoxicillin (Intramox-150®, Interchemie, Venerey, Holland) q24h IM. Amoxicillin works by binding to penicillin-

binding-proteins (PBPs) in bacterial cell wall synthesis, causing damage to the bacterial cell wall (Rahayu et al., 2021). Amoxicillin was chosen because it is effective against Gram-positive and some Gram-negative pathogens (Sachan et al., 2019). Steroid anti-inflammatory drug therapy with dexamethasone (Glucortine-20®, Interchemie, Venerey, Holland) q48h IM. Dexamethasone works as an anti-inflammatory, antipyretic, and analgesic (Nurrurozi et al., 2019). Given vitamin therapy (Curcuma Plus Appetite®, PT. SOHO Industri Pharmasi, Jakarta, Indonesia) and immune booster (Imboost Kids®, PT. SOHO Industri Pharmasi, Jakarta, Indonesia) q24h orally. Cats are also given a diet with dry food (Happy Cat Struvit®, Interquell GmBH, Germany).

RESULTS AND DISCUSSION

Results of the patient's physical examination (table 2). Physical examination found a decrease in CRT (capillary refill time) abnormalities. According to Mulyani et al. (2021), increased capillary refill time or CRT can be a clinical symptom of dehydration. Dehydration is defined as a lack of body fluids followed by loss of electrolytes and changes in acid-base.

Table 2. Results of Physical Examination of Patient

Types of Examination	Results	Normal Value	Information
Pulse rate (times/minute)	120	110 – 130	Normal
Heart rate (times/minute)	120	110 - 130	Normal
CRT (capillary refill time) (seconds)	3	< 2	Decrease
Respiratory rate (times/minute)	28	20 – 30	Normal
Temperature (℃)	38,3℃	37,8 – 39,2℃	Normal

Source: Riesta and Batan (2020).

On clinical examination (Table 3) abnormalities were found in the urogenital and mucosal parts. The normal cat mucosa is pink rose, but the patient's mucosa is pale. According to Mulyani et al. (2021), clinical symptoms in the mucous membrane in the form of changes to pale and dry can be clinical symptoms of dehydration. This can be related to the results in Table 2 showing a CRT value> 2 seconds which supports that the patient is dehydrated.

Table 3. Results of Clinical Examination of Patient

Types of Examination	Information
Skin and nails	Normal
Musculoskeletal	Normal
Nerves	Normal
Circulation	Normal
Respiration	Normal
Urogenital	Abnormal
Digestion	Normal
Eyes and ears	Normal
Lymph nodes	Normal
Mucos	Abnormal

The patient experiences difficulty urinating and from inspection, an enlargement of the abdomen can be seen. When palpated, abdominal distension can be felt which is not too tight followed by a pain response. This is in accordance with the results of the clinical examination (Table 3) with abdominal distension due to the volume of urine filling the urinary bladder. The patient's pain response is shown by meowing, avoiding, and showing

discomfort.

This is in accordance with Paramita et al. (2021), abdominal distension, precisely in the urinary bladder, will correlate with the occurrence of dysuria and stranguria due to obstruction of the urethra by debris, plugs, or crystals. This condition can direct the diagnosis to urinary disorders or Feline Lower Urinary Tract Disease (FLUTD). According to Azhar et al. (2022), patients suffering from FLUTD will show clinical signs including pain during urination (dysuria), obstruction of the urethra (stranguria), abdominal pain, and other clinical signs related to difficulty urinating. Factors that cause this condition are feline idiopathic, interstitial cystitis, urolithiasis, and bacterial infection.

The diagnosis of cystitis is based on the results of a physical examination, clinical signs, and supporting examinations. Clinical signs such as difficulty urinating and a pain response during urogenital palpation indicate a case of FLUTD. Supporting examinations are key to establishing a diagnosis of cystitis. Cystitis is an inflammatory disease of the urinary bladder (vesica urinaria) that can be caused by infectious and non-infectious agents. The non-infectious agents in question are minerals that undergo crystallization. The most common clinical signs associated with this disease are hematuria, dysuria, stranguria, pollakiuria, and urinary incontinence (Paramita et al., 2021). Accumulation of these agents can cause inflammation and injury due to friction with the mucosa of the urinary bladder (Dwiyana and Astrawinata, 2016).

Ultrasonography

Ultrasonography examination (PT50C Vet Touch Color Doppler Ultrasound System® BMV Technology, China) was performed to see the appearance of the cat's urinary bladder. The ultrasound results in Figure 2 show changes in the urinary bladder wall with a hyperechoic appearance in the form of thickening and color irregularities. Inside the urinary bladder also shows a hyperechoic appearance like sand flakes. This condition can be associated with inflammatory disease of the urinary bladder or called Cystitis.

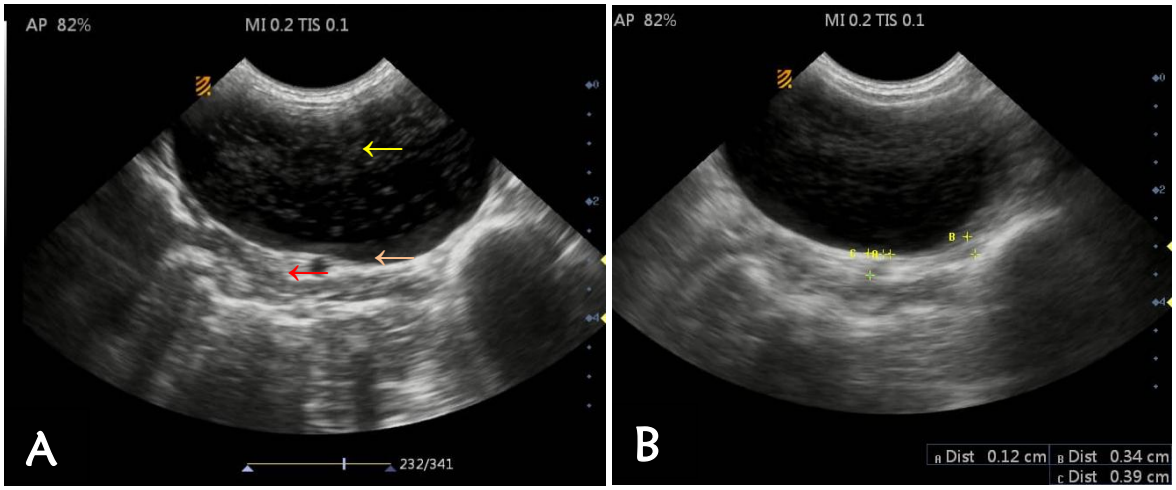

Figure 2. Ultrasonography examination results with dorsal recumbency position A. Hyperechoic debris appearance in the urinary bladder (yellow arrow) accompanied by thickening and irregularities in its walls (red arrow), exogenic sediment (green arrow); B. Calculation of urinary bladder wall thickness

In cases of cystitis, the results of an ultrasound examination will show a slightly thickened urinary bladder indicating inflammation of the wall. In some cases, in addition to

thickening, the wall will also experience hemorrhage and ulceration (Griffin, 2020). In Figure 2A (red arrow) it can be seen that a hyperechoic appearance occurs in the wall of the urinary bladder. This result is an interpretation of inflammation. Figure 2A (yellow arrow) shows fragments in the urinary bladder that can be interpreted as crystals. Echogenic sediment can also be seen in Figure 2A (green arrow) which shadows the inside of the urinary bladder. The sediment can be bacteria, gas, blood, or urine crystals. According to Caesar et al. (2021), the normal urinary bladder wall has a thickness of 0.10 - 0.15 cm when not distended and will be thinner when filled with urine. In the patient, the thickness of the urinary bladder wall can be seen in Figure 2B which shows a size of 0.34 x 0.39 cm when filled indicating abnormal thickening that can be caused by inflammation.

Hematology Examination

This hematology examination aims to see the general condition of the patient in order to determine whether or not there is an infection. The results of the blood test showed a decreased hemoglobin value, increased MCV, and decreased MCHC. Based on the MCV and MCHC values, it can be concluded that the patient has hypochromic macrocytic anemia. The condition of anemia is associated with three parameters, namely RBC, hemoglobin, and hematocrit values. Although the RBC and hematocrit values are within the reference values, the hemoglobin value has decreased. The low platelet value was obtained due to an error when transferring the sample from the syringe to the EDTA (ethylene diamine tetraacetic acid) tube.

Table 4. Hematology Results Of The Patient

Types of Examination	Results		Unit	Reference Value	Information
WBC	16.5		10^9/L	5.5 – 19.5	Normal
Limfosit#	3.9		10^9/L	0.8 – 7.0	Normal
Mid#	0.6		10^9/L	0.0 – 1.9	Normal
Granulosit#	12.0		10^9/L	2.1 – 15.0	Normal
Limfosit%	23.3		%	12.0 – 45.0	Normal
Mid%	3.6		%	2.0 – 9.0	Normal
Granulosit%	73.1		%	35.0 – 85.0	Normal
RBC	4.94		10^12/L	4.60 – 10.00	Normal
Hemoglobin	8.3	↓	g/dL	9.3 – 15.3	Abnormal
Hematokrit	29.7		%	28.0 – 49.0	Normal
MCV	60.2	↑	fL	39.0 – 52.0	Abnormal
MCH	16.8		pg	13.0 – 21.0	Normal
MCHC	279	↓	g/L	300 – 380	Abnormal
RDW-CV	17.4		%	14.0 – 18.0	Normal
RDW-SD	33.6		fL	20.0 – 80.0	Normal
Platelet	33↓		10^9/L	100 – 514	Abnormal
MPV	7.6		fL	5.0 – 11.8	Normal
PDW	7.5			5.0 – 20.0	Normal
PCT	0.025	↓	%	0.100 – 0.500	Abnormal
P-LCC	1.2		10^9/L		
P-LCR	37.4		%	10.0 – 70.0	Normal
Eos%	2.3		%		

Decreased hemoglobin indicates internal or external bleeding, cirrhosis, iron deficiency, and regenerative anemia caused by hemorrhage or hemolysis. This is related to the RBC cycle and abnormalities in hematopoiesis. Decreased hemoglobin indicates anemia. The clinical sign of anemia is that the mucosa will look pale (Prudenta et al., 2021). In accordance with

the findings of the clinical examination which showed pale mucosa.

Hematology results (Table 4) showed the occurrence of macrocytic hypochromic anemia with an increased MCV value (60.2 fL) accompanied by a decreased MCHC value (279 g/L). According to Paramitha et al. (2021), macrocytic anemia can be an indication of Fe deficiency or impaired Fe absorption and Cu deficiency. For the WBC value (16.5 x 10 ^ 9/L) is within the reference value indicating that there is no infection in the body. So, Cystitis occurs due to non-infectious agents, namely urinary mineral crystals.

Urine Native Test

Native urine examination is intended to see the presence or absence of hematuria, pyuria, proteinuria, bacteria and to determine the type of crystals that may be found. Various physiological and pathological conditions can cause urine to contain crystals. Crystalluria depends on many factors such as urine pH, urine specific gravity, duration since urine collection, storage conditions (eg temperature) since collection, and the presence of inhibitors or promoters of crystal formation. Some crystals, for example struvite, calcium oxalate dihydrate, amorphous crystals can be observed in native urine from normal animals. Other crystals are caused by or occur due to congenital metabolic disorders (cystine), acquired metabolic disorders (ammonium urate, tyrosine), and toxicity (calcium oxalate), or drug administration (sulfonamides) (Rizzi et al., 2017).
High Power Field (HPF) is a unit of the amount of a component such as crystals and blood per field of view in urine viewed under a microscope with 40x magnification. In cat urine, struvite and calcium oxalate crystals are normally found. This method can be used to assess the number of crystals in urine if it exceeds normal or not. Classification for crystals in urine (crystals/HPF) includes: rare (<2), few (2-5), moderate (6-10), and many (>10). While the normal value of erythrocytes in urine is 0-5 cells/HPF (Kovarikova et al., 2020).

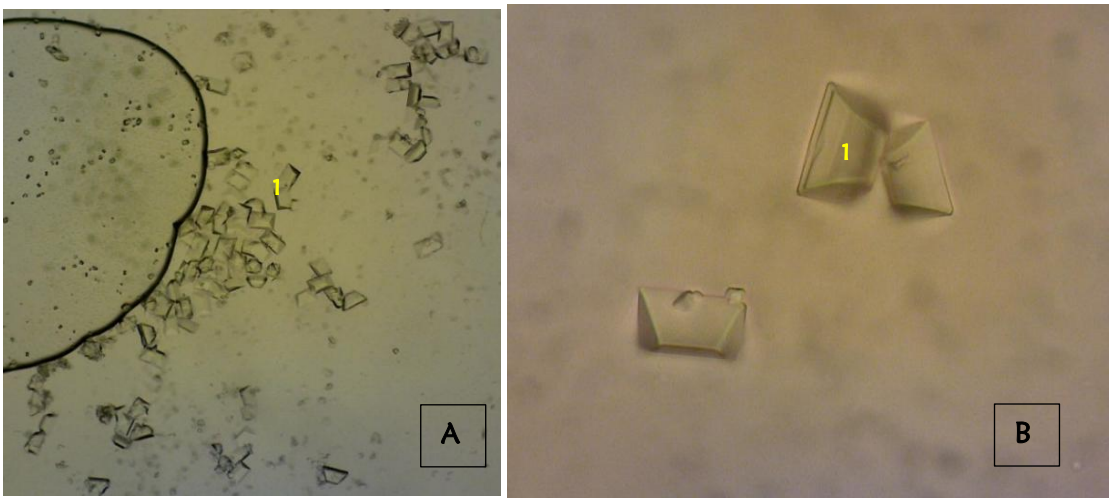

Figure 3. Native urine of the patient on day 1 after catheter insertion (A) 400x magnification; (B) 1000x magnification; 1. Struvite

Urine native test on day 1 after catheter insertion (Figure 3) showed the presence of mineral crystals, struvite type. Struvite crystals are colorless, prismatic, with protruding ends, and fern-like. Struvite crystals consist of magnesium and ammonium phosphate. These crystals indicate urinary tract bacterial infection, low urine volume, alkaline urine, and increased dietary magnesium levels (Rizzi et al., 2017). The results of the calculation of struvite crystals in urine were >10 crystals/HPF, namely with a value of ±75 crystals/HPF which is classified

as many and can cause accumulation into crystal stones or obstruction in the urinary system.

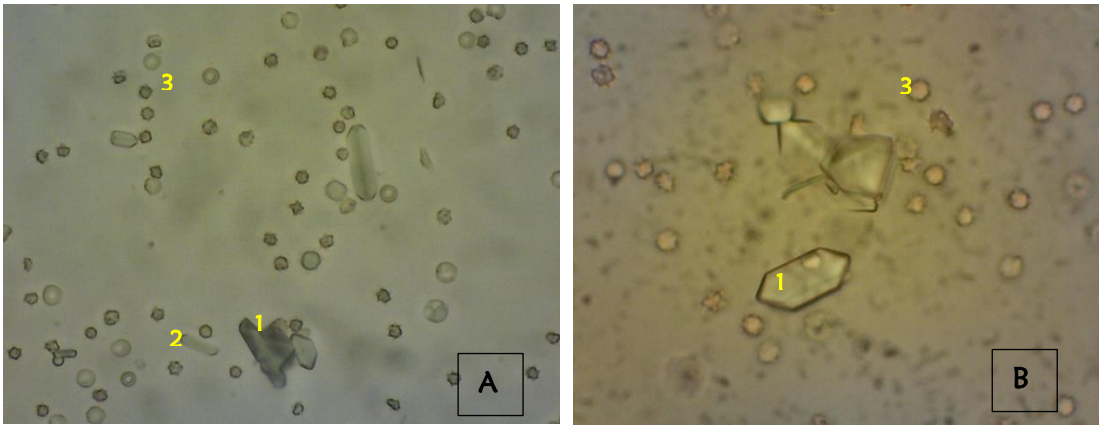

Figure 4. Native urine of the patient on the 3rd day after catheter insertion (A) 400x magnification; (B) 1000x magnification; 1. Struvite; 2. Calcium oxalate monohydrate; 3. RBC

Figure 4 shows the appearance of urine crystals with more diverse types compared to the previous native examination. Struvite, urate, calcium oxalate monohydrate, and erythrocyte types of urine crystals can be found, which can indicate hematuria. The results of the crystal count in urine, which is ±10 crystals/HPF, indicate that it is classified as moderate. Then, the erythrocyte count is ±11 cells/HPF, which indicates hematuria.

Calcium oxalate monohydrate crystals that are elongated and flat like a wooden fence. Calcium oxalate monohydrate crystals are the most common type of calcium oxalate crystals seen during ethylene glycol poisoning. This condition can be associated with hypercalcemia, hypercalciuria, and acidic urine. Therapeutically, it can be treated by increasing water intake and diet (Rizzi et al., 2017).

The presence of erythrocytes (hematuria) in this examination indicates injury to the urinary bladder mucosa by urine crystals, resulting in clinical signs in the form of hematuria (Dwiyana and Astrawinata, 2016). Erythrocytes are generally small, pale, round, biconcave discs and do not have a nucleus. In concentrated urine, erythrocytes will be smaller and wrinkled due to the loss of erythrocyte water into the hypertonic urine environment. Wrinkled erythrocytes appear pale and round with irregular surface protrusions. In isotonic urine, erythrocytes have normal morphology with a pale and round appearance, with smooth edges and a double concavity. In hypotonic urine, erythrocytes are swollen, lysed, larger, and not concave. The presence of erythrocytes in the urine indicates hematuria. Hematuria indicates that bleeding occurs from the bladder, ureter, renal pelvis, or kidney (Rizzi et al., 2017).

Urine Dipstick Test

Table 5. Results of the patient's urine dipstick test

Types of Examination	Results	Reference Value	Information
Protein	300(3.0) +++	-	Abnormal
pH	7.5	5.0	Basa
Glucose	-	-	Normal

Urine dipstick test showed high protein (300(3.0)). High protein in urine is called proteinuria. Proteinuria can be caused by pathological conditions such as kidney disease,

urinary tract infections, and hematuria, where red blood cells that come out due to bleeding contain protein (Yadav et al., 2020). In this case, it can be associated with hematuria due to inflammation of the urinary bladder.

The pH parameter in urine shows a value of 7.5 which can indicate alkaline urine. The pH level indicates alkaline urine which can be caused by a low-protein diet or due to the presence of urease-producing bacteria such as Staphylococcus aureus, Proteus sp., or Klebsiella sp. (Yadav et al., 2020). The patient was given HappyCat Struvit® feed with a low protein and mineral composition so that it can cause urine to become alkaline. which can cause urine to become alkaline. The feed has low phosphorus and magnesium minerals so that it can prevent the formation of struvite crystals so that recurrent cases can be prevented.

Bacterial Culture

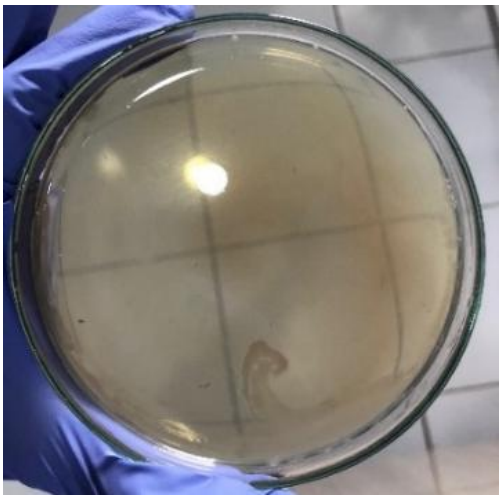

Figure 5. Urine Bacterial Culture

Bacterial culture using NA (Nutrient Agar) media as a general medium that provides nutrients for the growth of both gram-positive and gram-negative bacteria. The nutritional content is nitrogen, carbon, vitamins, and salts. The results showed no bacteria growing. So, the cystitis that occurs is not caused by bacterial infection.

Treatment

Evaluation of physical characteristics includes color, odor, clarity (turbidity), and volume. Day 1 (Figure 8) after catheter insertion, urine appears yellow-orange. Cloudy urine can be caused by an increase in the number of cells, crystals, casts, or organisms (Paramita et al., 2021). On the 3rd day, urine is red, indicating hematuria due to friction of crystals in the urinary bladder.

Infusion is needed for patients who have a catheter with an indication that urine will continue to flow in large amounts so that fluid therapy is needed. Infusion serves to maintain fluid balance in the body. Water balance is essential in metabolism and dissolves metabolic products so that they can be utilized by body cells. The main purpose of fluid therapy is to overcome dehydration, restore blood circulation volume in hypovolemia, or shock. Ringer Lactate is chosen because it can restore and maintain electrolytes (Na + and K +) and acid-base in the body towards normal limits (Paramita et al., 2021).

The treatment therapy given to patients is the administration of antibiotics, anti-

inflammatories, and supportive care such as vitamins and immune boosters. Amoxicillin was chosen because it is effective against Gram-positive bacteria and some Gram-negative pathogens (Sachan et al., 2019). Anti-inflammatory steroids are used in handling this case, namely dexamethasone which works by inhibiting inflammatory cells and suppressing the release of inflammatory mediators (Nurrurozi et al., 2019). Non-invasive treatment is carried out in addition to antibiotic and anti-inflammatory therapy, also by administering supportive drugs and diet. The vitamin support used is Curcuma Plus Appetite® with Lysine content, and the immune booster Imboost Kids®. Dietary care is applied because it has a very effective impact on reducing mineral crystals. A diet with reduced protein, phosphorus and magnesium which encourages the formation of acidic urine can reduce mineral precipitation. The risk of urine mineral formation will increase if you consume high levels of magnesium, phosphorus, calcium, chloride, and fiber (Mariyana et al., 2022).

Antibiotics are given to prevent bacterial infections caused by the catheter. Anti-inflammatories are given to treat inflammation in the urinary bladder. On the 3rd day after the catheter, the patient began to improve with the results of urine observations under a microscope showing that the number of crystals was classified as moderate, which was previously classified as many. After 7 days of therapy, the patient's condition improved with urine that was not accompanied by blood and the patient's physical condition was no longer dehydrated.

Conclusion

Cystitis is an inflammation of the urinary bladder (Vesica urinaria) caused by infectious and non-infectious agents that can be treated with catheter installation, fluid therapy, antibiotics, anti-inflammatories, and supportive drugs such as vitamins and immune boosters. The actions and therapies given showed good results with improved conditions in case animals so that the cat after 3 days of treatment the patient was active again and given outpatient care.

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