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Short Communication

Secondary renal azotemia and peritonitis associated with urolithiasis in a Cocker Spaniel dog - Diagnostic and clinical management

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Abstract

Urolithiasis is a common cause of lower urinary tract disease in dogs and cats, and conditions causing post-renal azotaemia result in intrinsic renal damage. An eleven-month-old male Cocker Spaniel was presented with a distended abdomen, anorexia, dyschezia and anuria. Radiological examination revealed the presence of uroliths in the urinary bladder and at the ischial arch. An ultrasonogram of the abdomen showed cystic calculus, peritoneal fluid effusion, confirmatory hepatic changes on USG, hepatojugular blood flow and altered renal architecture. Cytological analysis of abdominal fluid revealed neutrophilia. Haemato-biochemical analysis revealed leukopenia, neutrophilia, lymphopenia, and increased levels of blood urea nitrogen, creatinine and bilirubin. Kidney dysfunction resulted in systemic disturbances, hepatic changes and ascites were observed due to the portal hypertension. The case was treated with antibiotics, diuretics, anti-inflammatory drugs, hepatic stimulants, renal rejuvenating agents and ethno-veterinary medicines to dissolve the uroliths. The case recovered uneventfully after a course of treatment for two weeks.

Keywords: Portal hypertension**,** Radiography, Renal azotemia, Ultrasonography, Urolithiasis

Highlights

- Renal disease in a Cocker-Spaniel dog was observed as a complication of urolithiasis in a male Cocker Spaniel dog.
- Haematuria, hepatic changes and ascites with peritonitis were observed as complications of renal disease.
- Haemato-biochemical alterations associated with the hepato-renal changes were observed.
- The case responded to the treatment with ethno-veterinary drugs, antibiotics, and renal and hepatic stimulants.

Urinary tract obstruction is one of the causes of postrenal azotemia, and urolithiasis is a common cause of lower urinary tract disease in dogs and cats (Slatter, 2003). Cystoliths, struvite and oxalates are reported to be the most common cystoliths (Fossum, 2007), whereas calcium phosphate uroliths are uncommon in dogs and are usually associated with metabolic disorders, renal tubular acidosis and excessive calcium and phosphate diets (Osborne *et al*., 2009). Surgical management is reported to be a more effective treatment of canine urolithiasis (Saharan *et al.*, 2018). Interference in the excretion of urine leads to azotemia, which can rapidly result in life-threatening fluid, electrolyte, and acid-base imbalances (Fischer *et al*., 2009).

Conditions causing pre renal and post renal azotemia can also result in intrinsic renal damage if not identified. The clinic-pathological complications associated with postrenal azotemia may range from mild to life-threatening (Fischer *et al*., 2009).

Ascites is the accumulation of serous or serosanguinous fluid in peritoneal space (Pradhan *et al*., 2008) and is a clinical manifestation of an underlying disease condition like hepatic diseases, kidney malfunction, right side heart failure, hypoproteinaemia, neoplasms, peritonitis, bleeding disorders, malnutrition, increased capillary permeability in inflammatory conditions, hepatic portal hypertension, and hookworm infestation. Hence, the identification of the cause of ascites may not be a straightforward procedure, as it could be associated with several causative factors (Bekoe *et al*., 2020; Hemanth *et al*., 2020). Ultrasonography could be a more valuable tool to rule out the complications of

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kidney disease and other renal disorders (like hydronephrosis, renal cysts and sarcoma), which may help in choosing an aggressive therapy or alternate diagnostic methods or prognosis.

However, serum biochemical analysis including total protein, albumin, creatinine, urea, liver enzymes and coagulation profile would help in revealing cases of hypoalbuminaemia, hypoproteinaemia and hepatic/ kidney disorders. Abdominal paracentesis in conjunction with appropriate treatment is reported to be useful in reducing the fluid accumulation to relieve respiratory distress and recovery from the underlying cause (EASL, 2010).

This paper reports the incidence of acute renal azotemia and peritonitis associated with the recurrent formation of uroliths in the urinary tract of a Cocker Spaniel dog, diagnosis by ultrasonography and radiography, and its successful therapeutic management.

An 11-month-old male Cocker Spaniel was presented with a history of a distended abdomen, anorexia and dyschezia, anuria for 3 days. Clinical examination of the dog revealed bilaterally distended abdomen with a pear shape (Fig. 1) and a fluid thrill wave by tactile percussion of the abdomen. Physical examination revealed elevated body temperature (103.5°F), respiration rate (45/min), pulse rate (118/ min) and heart rate (135/min), congested mucus membrane, bilateral mucoid ocular discharge and mildly sunken eyeball.

The lower urinary tract (LUT) obstruction could be diagnosed based on the history of signs and palpation of a turgid, painful urinary bladder by physical examination. Urine could not be collected by urethral catheterization due to obstruction; hence, a radiological examination (Fig. 2) of the abdomen and pelvis was performed to identify the cause of obstruction. Cystocentesis (Fig. 3) was performed to collect urine, which was sent for analysis. Abdominocentesis (Fig. 4) by single paracentesis was performed for cytological analysis of the abdominal fluid (Jandrey, 2018), and about 200 mL of straw-coloured fluid was collected and sent for analysis. Ultrasonogram (Fig. 5) of the abdomen was performed to identify the pathological changes in the abdominal cavity (Mayhew and Holt, 2004). Peripheral collected blood smears were to rule out haemoparasitic infections. Whole blood and serum samples were collected for haemato-biochemical analysis. Blood in EDTA was collected to rule out babesiosis, ehrlichiosis and leptospirosis by polymerase chain reaction (PCR).

Radiological examination revealed the presence of uroliths in the urinary bladder and at the ischial arch (Fig. 2). An ultrasonogram of the abdomen showed a hyperechoic structure (cystic calculus) with an acoustic shadow on the urinary bladder wall (Fig. 5) and peritoneal fluid effusion indicating peritonitis (Fig. 6). Hepatic changes (Fig. 7) by ultrasonogram revealed the rounded tip of the liver lobe and hyperechoic portal veins, indicating an inflammatory process. With the conventional colour Doppler, a distended portal vein associated with the reversed flow (hepatofugal) appeared as a red signal and hepatic veins draining into the caudal vena cava appeared as a blue signal. An ultrasonogram of kidneys (Fig. 8) showed small and irregular right kidney with a smooth, enlarged cortex, loss of cortico-medullary distinction and renal architecture, suggesting kidney disease.

Cytological analysis of the collected abdominal fluid revealed neutrophils and urinalysis revealed red coloured urine, the presence of numerous red blood cells, proteinuria, moderate amorphous crystals, pH - 6.5, and specific gravity- 1.015, whereas urobilinogen, bile pigments and glucose were absent.

The peripheral blood smear examination and polymerase chain reaction (PCR) with species-specific primers revealed the absence of Babesia, *Ehrlichia canis*, *Hepatozoan canis* and *Leptospira interrogans*, which may be involved in the pathology of the hepato-renal syndrome. Haematological analysis revealed elevated levels of white blood cells ($3.47x10^3$/µL) and neutrophils (90.0%), reduction in lymphocytes (10.0%), whereas the packed cell volume (54.9%), platelets ($1.7x10^3$/µL, red blood cells ($8.27x10^6$/uL) and haemoglobin (18.1 g/dL) were found within normal levels. Serum biochemical analysis revealed elevated levels of blood urea nitrogen (471 mg/dL), creatinine (11.1 mg/dL), alkaline phosphatase (344.0 IU/dL), total bilirubin (1.5 mg/dL), direct bilirubin (0.6 mg/dL), and phosphorus (12.7 mg/dL), low level of glucose (14 mg/dL) and chloride (139 mmol/L). Whereas total protein (6.1 mg/dL), albumin (2.9 mg/dL), globulin (3.2 mg/dL), alanine aminotransferase (21 mg/dL), calcium (9.1 mg/dL), sodium (146.81 mmol/L) and potassium (5.1 meq/L) were found within normal levels.

Abdominal radiography is generally recommended to diagnose urolithiasis as it has more accuracy in predicting the stone size, and abdominal ultrasonography has 90% sensitivity, 98% specificity and 97% accuracy (Webb, 2000). Urethral obstruction is more common in male dogs than female dogs (Mendoza-Lopez *et al*., 2017; Parmar *et al*., 2021) due to anatomic characteristics, toy breeds and small

Fig. 1. Cocker Spaniel dog with bilaterally distended abdomen and lateral recumbency (before treatment)

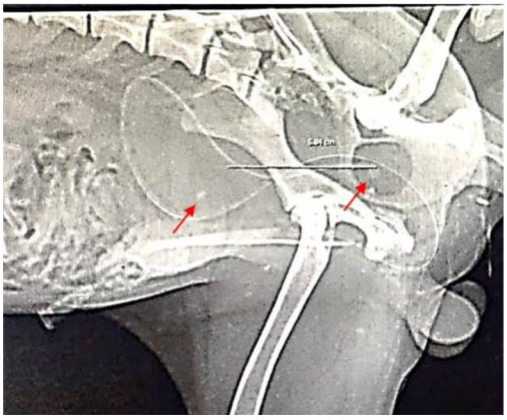

Fig. 2. A calculus (arrow marked) in the urethral passage at ischial arch

Fig. 3. Cystocentesis showing hematuria

Fig. 4. Abdominocentesis by single paracentesis method

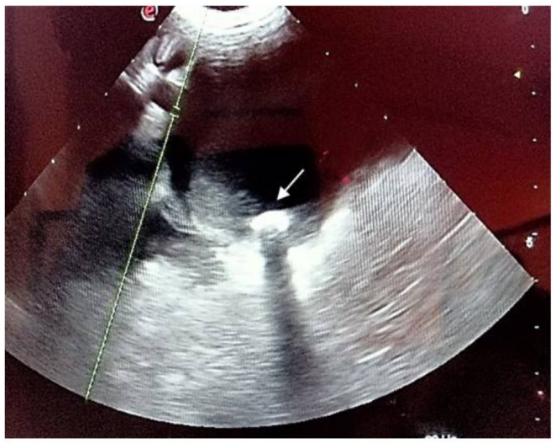

Fig. 5. Ultrasonogram of abdomen showing a hyperechoic structure (cystic calculus; arrow marked) with an acoustic shadow on the urinary bladder wall

Fig. 6. Ultrasonogram of abdominal cavity showing effusion of anechoic peritoneal fluid indicating ascites (star marked)

Post renal azotemia associated with urolithiasis in a dog

Fig. 7. Distended portal vein associated with reversed flow (hepatofugal; red signal) on color Doppler

Fig. 8. Longitudinal image showing a small, irregular right kidney with a smooth, enlarged cortex, loss of cortico-medullary distinction and renal architecture

Fig. 9. Sagittal image of left Kidney (normal)- The fat surrounding the renal pelvis forms a central hyperechoic line

Fig. 10. Cocker Spaniel dog showing abdomen of normal contour and standing posture (after treatment)

Fig. 11. Urinary bladder free of uroliths after treatment

Fig. 12. Normal architecture of the liver lobe after recovery

breeds of dogs (Okafor *et al*., 2014). In this case, a single urolith was observed both in the urinary bladder and in the penis at the ischial arch by radiographic and ultrasonographic examination, as uroliths are reported to most often lodge at the ischial arch or just proximal to the os penis (Shah *et al*., 2018). Clinical signs like haematuria, pollakiuria and stranguria are reported to be associated with cystic or urethral calculi (Dehmiwal *et al*., 2016). Bigger urolith may lead to obstruction of the urine flow, necessitating surgical intervention (Yadav *et al*., 2011).

Hematuria is reported to be a common finding in animals with lower urinary tract obstruction, whereas microscopic haematuria may be present with upper urinary tract obstruction with gross haematuria being uncommon (Fischer *et al*., 2009). Chewing the toy bones was found to be the risk factor for the occurrence of urolithiasis, since high levels of minerals in the diet and excess protein could also contribute to the disease (Sharma *et al*., 2020), as this case had the habit of chewing toy bones.

Loss of kidney function influences endocrine and metabolic functions, resulting in generalized systemic disturbances (Bartges, 2012). Chronic kidney disease (CKD) may occur as a complication of acute nephropathy (Huguet *et al*., 2023), and clinical signs are apparent when normal kidney function is reduced by two-thirds. The renal impairment could be associated with the development of splanchnic vasodilatation and a decrease in mean arterial pressure. In addition, activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system could result in renal vasoconstriction (EASL, 2010).

The ascites manifested in this case could be associated with hepatic diseases like portal hypertension and hepatitis, which could also be ultrasonographically observed. Portal hypertension can be noticed if the portal flow is found to be significantly low in velocity associated with a dilated portal vein. The ultrasonographic changes of the kidneys, liver and urinary bladder observed in this case are following the pathological findings reported by Penninck and d'Anjou (2015). Ascitic fluid as clear straw-coloured fluid (modified transudate) is often characterized by the presence of fibrin cells and white blood cells and is reported to be observed in long-standing ascitic cases (Ettinger, 2005).

The neutrophilia and associated leukocytosis observed in this case could be attributed to the inflammatory response resulting in peritonitis. The elevated levels of ALP and bilirubin (total and direct) in this case could be attributed to hepatocellular degeneration as a complication of post-renal azotemia (stage 4), which resulted in increased levels of BUN, creatinine and phosphorus in serum. These findings are in accordance with that of Hemanth *et al*. (2020), who also observed an elevated level of ALP, however, with hypoproteinaemia and hypoalbuminemia, and normal levels of BUN and creatinine in a Dachshund pup with ascites.

The case was treated with parenteral administration of doxycycline @10 mg/kg bwt as an antibiotic, furosemide @ 2 mg/kg bwt as diuretic and chlorpheniramine maleate @ 0.5 mg/kg bwt as an anti-inflammatory agent (Hemanth *et al*., 2020), dextrose normal saline, Dextrose 25%, Ringer's lactate and thiamine (Tribivet®). Oral administration of silymarin (Tefroliforte®) as a hepatic stimulant and renal probiotics (Renodis®) as a renal rejuvenating agent. Retrograde urethral hydro propulsion (Mendoza-Lopez *et al*., 2017) was attempted; however, it failed to remove the urethral calculi in this case. Hence, ethno-veterinary medicines, including Cantharis (30x), Apismellifica (30x) and Berberisvulgaris (30x), were recommended orally for three days to dissolve the uroliths. These homoeopathic remedies were found to be useful in reducing the intensity of symptoms, chances of recurrence of urolithiasis and dependence over surgery (Rathore *et al*., 2021). The case recovered successfully with the absence of uroliths, normal urination, food intake, abdomen of normal contour and standing posture after a course of treatment for 15 days (Fig. 10). The radiography and ultrasonography revealed dissolution of uroliths, normal kidney and liver architecture and the haemato-biochemical values were within range (Fig. 11 and Fig. 12).

Diets that lower urinary calcium oxalate, phosphate and magnesium could predispose to urolithiasis and thereby post renal azotemia. Investigation of the case based on history, physical examination, imaging technique and radiography could be useful in the identification of uroliths, associated renal azotemia, hepatic abnormalities and ascites. Hence, medical intervention at an early stage could prevent or minimize the possibility of complications like secondary renal azotemia and hepatic dysfunction and save the life of the animal.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: SS: Involved in the diagnosis of urolithiasis by USG and clinical management; RR: Involved in draft of the manuscript; RCS: Involved in

supporting the clinical diagnosis; DV: Involved in the radiological diagnosis.

Data availability statement: This article includes all data generated or analyzed during this study. The corresponding author is willing to provide the raw data upon reasonable request.

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