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Cystolith in a dog: A case report

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Abstract

A two-year old dachshund female dog was presented to a private clinic with a history of dysuria and hematuria since 5 days. The other signs exhibited included vomiting, anorexia and abdominal discomfort. The temperature, pulse and respiratory rates were elevated. On abdominal palpation, the bladder was found to be distended and yet the dog could not be induced to urinate. Abdominal radiography showed a radioopaque oval calculi in the urinary bladder. After anaesthetizing with xylazine @ 1 mg/kg and ketamine @ 5mg/kg, mid ventral laparotomy followed by cystotomy was performed and a single large calculi (4.5 cm x 3.5 cm) was removed. The urinary bladder wall was moderately thickened. The calculi was ellipsoidal in shape, white to light yellow in color with surface porosity and weighed 45 g. Biochemical analysis of the crystals revealed presence of calcium and magnesium phosphates. Following cystotomy and its management, the animal had an uneventful recovery.

Keywords: Cystotomy, radiography, urine incontinence, urolithiasis

Introduction

Urolithiasis is a general term referring to aggregates of crystalline and occasionally non crystalline solid substances that form in one or more locations within the urinary tract [1]. Uroliths that develop in the bladder are cystoliths. When urine becomes oversaturated with lithogenic substances, uroliths may be formed and these can interfere with the complete and frequent voiding of urine [2]. Increased urine salt concentration, decreased water intake, increased irreversible water losses, increased mineral excretion, urinary tract inflammation, change in urine pH are the major predisposing causes that may lead to the formation of calculi in the urinary tract.

Three main contributing factors involved in urolith formation are 1) matrix—the inorganic protein core that facilitates initial urolith formation, 2) crystallization inhibitors—organic and inorganic crystallization inhibitors may be lacking or dysfunctional in animals with uroliths, and 3) precipitation crystallization factors—a complex relationship among urine solutes and other chemical factors in the urine that can lead to conditions favoring crystallization. Regardless of the underlying mechanism(s), uroliths are not produced unless sufficiently high urine concentrations of urolith-forming constituents exist and transit time of crystals within the urinary tract is prolonged and for certain stones (eg, struvite, cystine, urate), other favorable conditions (eg, proper pH) for crystallization must also exist. These criteria can be affected by urinary tract infection, diet, intestinal absorption, urine volume, frequency of urination, therapeutic agents, and genetics [3]

Urolith analysis provides essential information in the management and prevention of further urolith formation.

Materials and methods

A two-year old dachshund female dog was presented to a private clinic with a history of dysuria and hematuria since 5 days. The other signs exhibited included vomiting, anorexia and abdominal discomfort. After general clinical examination, venous blood sampling was carried out for complete blood count (CBC) and the serum biochemical analysis for blood urea nitrogen and creatinine. Following abdominal radiography, cystotomy was performed.

Results

The blood picture showed mild leukocytosis (16,000 cells/cmm). The DLC revealed neutrophilia (94% neutrophils, 6% lymphocytes). The serum blood urea nitrogen and creatinine levels were 78 g/dl and 3.1 mg/dl respectively.

On abdominal palpation, the bladder was found to be distended and yet the dog could not be induced to urinate. Abdominal radiography showed a radioopaque oval calculi in the urinary bladder (Fig. 1). Clinical and imaging findings were compatible with the diagnosis of urolithiasis and associated uraemia.

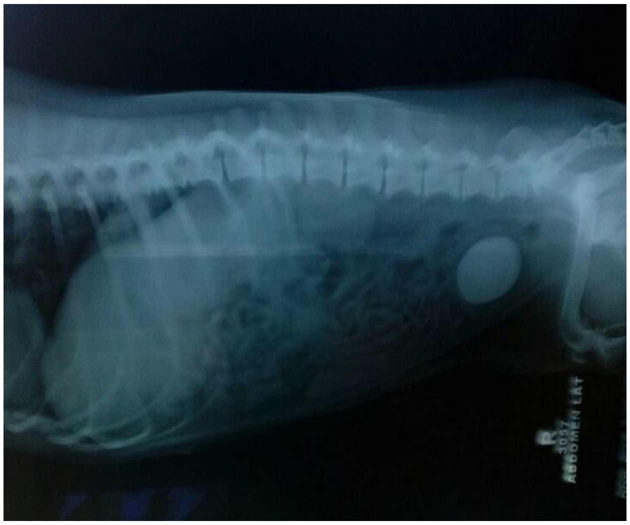

Fig 1: Abdominal radiography showing radioopaque oval calculi in the urinary bladder

After anaesthetizing with xylazine (@ 1 mg/kg) and ketamine (@ 5mg/kg), mid ventral laparotomy followed by cystotomy was performed. The urinary bladder wall was moderately thickened and oedematous and the blood vessels on the serosal surface were severely engorged (Fig: 2).

Fig 2: Urinary bladder with engorged serosal blood vessels.

A single large calculi that measured 4.5 cm x 3.5 cm was removed from the bladder (Fig. 3). The calculi was ellipsoidal in shape, white to light yellow in color with surface porosity and weighed 45 g. Post-operatively, the animal was given Ceftrioxone @ 20mg/kg BW IV daily for five days, Meloxicam @ 0.2mg/kg BW IM and DNS @ 15ml/kg BW IV daily for five days. The animal had an uneventful recovery and no recurrence was observed during the six month follow up period.
Microscopic analysis of the urolith revealed struvite crystals with characteristic coffin lid appearance (Fig: 4). Biochemical analysis of the crystals revealed presence of calcium and magnesium phosphates.

Fig 3: Single large ellipsoidal cystolith with surface porosity

Fig 4: Struvite crystals from the cystilith

Discussion

The urinary system is designed to dispose of metabolic wastes in liquid form. However during urolith formation, sustained alterations in urine composition promote over saturation of one or more substances eliminated in the urine and result in their precipitation and subsequent growth. Renal calculi are a common problem in dogs [4].
In this report, a urolith has been surgically removed from the urinary bladder of a two year old dachshund female dog. Dachshund breed has been reported to have a higher frequency of urolithiasis [5, 6]. Contrary to human beings, the kidneys are not the common sites for calculi lodgment in dog as about 95% of calculi in dogs are found either in the bladder or urethra and bladder together [7]. The most frequent anatomical location of calculi in male is urethra followed by urinary bladder, however, calculi in females are usually located in the urinary bladder [8-10].
The clinical signs exhibited by the dog were in accordance to those reported in earlier reports of canine urolithiasis [11, 12]. Haematuria and dysuria exhibited by dogs might be due to irritation of bladder mucosa caused by uroliths. lncreased level of BUN and creatinine have been recorded in cases of urolithiasis in canine and is attributed to prolonged retention of urine [11,12,13]. Elevated creatinine level could be due to renal damage caused by hydrostatic pressure on the kidney and increased reabsorption of creatinine from bladder due to prolonged stasis of urine in the urinary bladder [14].
Radiography can be used to diagnose the conditions of cystic

calculi but the diagnosis becomes challenging if urinary stones are radiolucent [15, 16]. In the present case the calculi could be visualized clearly by radiography. Magnesium ammonium phosphate, calcium oxalate, calcium phosphate, silica and cystine crystals are often radiodense

Physical characteristics may serve as a preliminary and tentative indicator of the composition of the calculi and thereby assist in establishing the etiological factors. Microscopic examination of crystals in urine is of diagnostic importance as different crystals have different appearance. In the present case, the calculi was single, large, ellipsoidal in shape with surface porosity. Similar physical characteristics has been described for phosphate uroliths in earlier reports [17, 18].

Urolith analysis is a well-established procedure in the characterization of urolithiasis. A major deficiency of the qualitative method is a failure to identify the major component of mixed uroliths. Mixed uroliths represents a problem in classification that can be clarified only by using a quantitative method measurement. Knowledge of the mineral composition of calculi helps direct appropriate management of urolithiasis. In the present case, chemical analysis of the urolith revealed presence of calcium and magnesium phosphates. Microscopic analysis of the urolith was suggestive of struvite. The bladder is the most common site of phosphate urolith, and phosphate has been reported as the main constituent in canine urolithiasis especially uroliths of female dogs [5, 19, 20, 21, 22]. The major component of phosphate uroliths is magnesium ammonium phosphate (Struvite) [6, 23].

lnfrequent urination, as a result of confinement, lack of regular exercise, reduced water intake contribute to formation of crystals and uroliths. High levels of minerals in the diet and sometimes calcium have been directly linked to canine urinary bladder calculi formation. A diet with excess protein can also contribute to calculi formation [24].

Urine retained for more than 24 hours becomes alkaline due to release of ammonia from the breakdown of urea [25]. Phosphate calculi are formed rapidly in alkaline urine but are more soluble in acidic urine. Alkaline urine may lead to precipitation of struvite, calcium carbonate and calcium phosphate calculi [26, 27]. Urinary tract infection may predispose the urinary tract to the formation of calculi. Struvite calculus in dogs is primarily linked to urinary tract infections [28].

Conclusion

Following surgical intervention, proper general and dietary management is required to prevent reoccurrence of cystoliths. A general recommendation for prevention of urolithiasis is to increase water consumption to encourage diuresis and reduce time for aggregation and crystallization [29]. Hypercalciurea, alkaline urine pH, increased matrix, decreased crystallization inhibitors, urinary hyperconcentration and retention of urine are the major risk factors involved in phosphate lithiasis. Urine acidifiers are useful prophylactic agents for phosphate calculi. Dogs must be fed diets that lower urinary phosphate and magnesium and maintain acidic urine.

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