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RESEARCH ARTICLE

THE DIAGNOSIS OF STRUVITE CYSTOLITH WITH IMAGING TECHNIQUES IN A DOG AND ITS MANAGEMENT

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ABSTRACT

A five years old Pomeranian bitch having 7 kg body weight was presented to the Teaching Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, CAU, Selesih, Aizawl, Mizoram with a history of straining to urinate, dribbling of bloody tinged urine, anorexia since one week. The patient was mildly dehydrated and dull. Palpation of the ventral abdomen elicited discomfort. Observation at micturition revealed that blood was voided at the end of micturition. Lateral and ventro-dorsal radiography revealed the presence of bladder calculi. Ultrasound examination showed presence of a hyperechoic mass with clear acoustic shadow indicative of calculus with cystitis. The calculus measured about 2.5 cm horizontal diameter and 2.75 cm vertical diameter and weight was 10 gm. The urine appeared anechoic with no debris and the bladder wall measured 0.2 mm thickness. The calculus was successfully removed by a cystotomy procedure.

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INTRODUCTION

Cystoliths are concretions of solid mineral and organic compounds that cause disease through direct trauma to the urinary tract and obstruction of urinary outflow (Kalim *et al*., 2011). There are different types of cystolith including struvite, calcium oxalate, calcium carbonate, calcium phosphate, silica, uric acid, cystine and tyrosine crystals (Samal *et al*., 2011). The alkaline pH (pH>8.0) of urine favors the formation of phosphate, carbonate and struvite calculi while acidic pH (pH<7.0) predisposes to urate and silicate calculi (Pugh, 2002). Urinary calculi are very common in dogs (Makkena *et al.,* 1999). Cystolithiasis occurs in 0.4-2% of the canine population (Morgan, 1997) and smaller dog breeds are more prone than larger breeds (Lulich *et al*., 2000) and are more common in middle-aged dogs. Cystolithiasis is defined as the macroscopic precipitation of crystals in urine. Proper diagnosis of calculus in dogs provide key for the selection of the treatment regimen. Calculi is the common cause of radiopacities associated with the urinary tract detected radiographically (Johnston *et al*., 1995). Radiographic evaluation of urinary bladder was useful to detect the site, number, density and shape of calculi obstructing the urinary bladder (Osborne *et al*., 1990).

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Ultrasonography is used to evaluate the nature of the bladder and its contents. Calculi have mineral composition and thus facilitate visualization using ultrasound due to the formation of acoustic shadows distal to them. Treatment of calculi may be either medical or surgical management. Medical management involves the dissolution of the crystals by affecting the mechanisms mentioned above. Surgical management involves removal of the calculi by cystotomy or urethrostomy procedures. A thorough physical and anaesthetic risk evaluation should be a prerequisite to the surgery due to the compromised electrolyte imbalance. The present study reports the successful surgical management of cystic calculi.

History and clinical observations

A 5 year old Pomeranian bitch (case no 2040) having 7 kg body weight was presented to the Teaching Veterinary Clinical Complex, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, with the history of straining to urinate, dribbling bloody tinged urine since one week. On physical examination, the bitch was dehydrated with tense abdomen; attributed to pain and distended urinary bladder. Clinical examination revealed slightly elevated rectal temperature (103.8°F), heart rate and respiration rate. Ultrasonography of caudal abdomen revealed thickened urinary bladder (cystitis) with an ovoid hyper-echoic mass which cast a clear acoustic shadow (Fig. 1).

Fig-1: Ultrasonography of urinary bladder revealed empty thickened urinary bladder (cystitis) with an ovoid shaped hyperechoic mass with acoustic shadow indicative of urolith

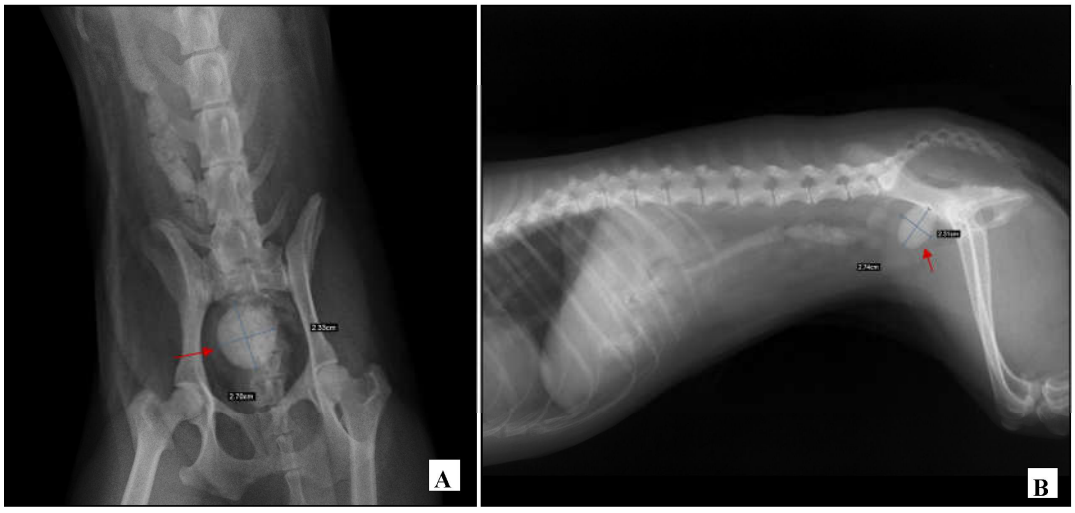

Fig-2: Lateral (A) and ventro-dorsal (B) radiograph of pelvis revealed the presence of a radiodense single big mass in the urinary bladder which was ruled as a cystolith

The hyper-echogenicity of the mass suggested a mineral composition which is consistent with a bladder calculus. Computed radiographic examination of lateral and ventro-dorsal pelvis revealed the presence of a radiopaque single big mass in the urinary bladder which was ruled as a cystolith (Fig. 2). The internal calipers of the radiography facilitated the measurement of the mass which was 2.5 cm in horizontal diameter and 2.75 cm in vertical diameter. Urinalysis of the urine sample revealed presence of leukocytes, erythrocytes, protein, blood and epithelial cells. Total red blood cell, total leukocytic count, haemoglobin concentration, blood urea nitrogen and serum creatinine level were recorded preoperatively as 4.17 mill/cumm, 9177 cells/cumm and 11.2 gm/dl, 24.7 mg/dl and 0.95 mg/dl respectively. Haematological and biochemical parameters of the bitch was within the normal range indicating that renal damage has not yet ensued and the dog was clinically fit to undergo surgery.

TREATMENT DISCUSSION

Dog was prepared for ventral abdominal laparotomy. Animal was premedicated with DNS @ 15ml/kg BW IV, Meloxicam @ 0.2mg/kg BW IM and Ceftriaxone @ 20 mg/kg BW IV. The surgical site was prepared for aseptic surgery. Anaesthetized the bitch with Diazepam @1mg/kg BW IV and Ketamine @10mg/kg BW IV and Lignocaine @ 2mg/Kg BW was infiltrated at the caudal mid-ventral site for operation. With the animal in dorsal recumbency, the urinary bladder was approached through a caudal ventral midline laparotomy, elevated the urinary bladder through the laparotomy site and isolated from the surrounding viscera with saline moistened pads to minimize abdominal contamination. As the urinary bladder was empty, the ventral avascular surface of the urinary bladder was selected for cystotomy. The ventral cystotomy was made with a stab incision and the incision was lengthened with mayo scissor to remove the cystolith by grasping with forceps (Fig.3). Repeated flashing and aspirations were done to clean the urinary bladder with normal saline solution. As the bladder wall was thickened due to cystitis, an intraluminal simple continuous pattern was used for the first layer followed by a simple continuous pattern for the second layer for the cystotomy closure with monofilament synthetic absorbable suture material (2-0 Vicryl). The laparotomy incision was sutured with 1-0 Vicryl followed by subcuticular and skin suture. 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 three days. The animal made uneventful recovery. The removed big calculus was oval in shape and slight brown in colour (Fig.3 F&G). The size of the calculus was 2.5× 2.75cm, weighing 10gm with rough margin. The calculus was identified as struvite crystal by microscopic observation (Fig.4).

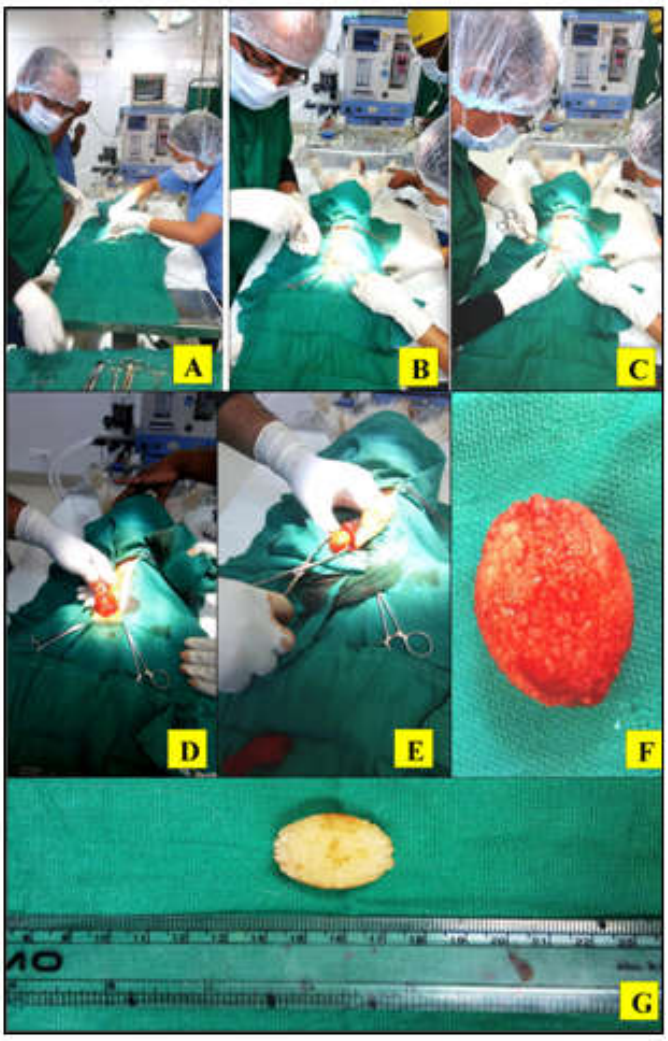

Fig.3. Surgical procedure for cystotomy. Chronological orders from A to E. F& G: 10 gm cystolith measuring 2.5X2.75cm size with rough margin

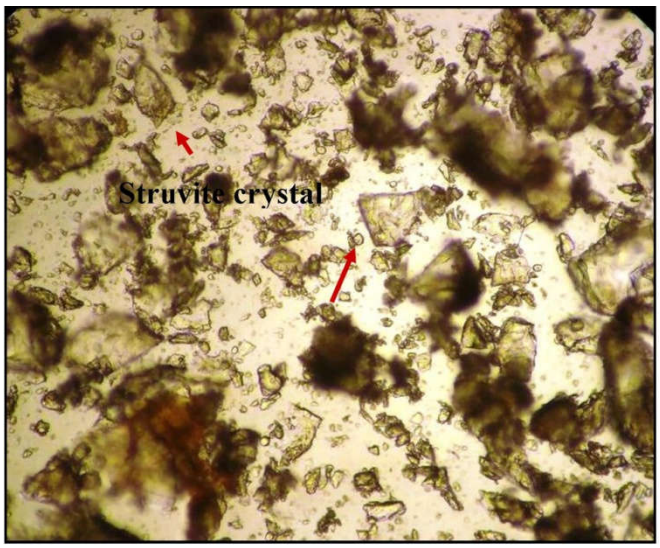

Fig.4. Microscopic Examination of cystolith was identified as struvite crystal on the basis of its shape.

The present report describes a five years old Pomeranian bitch with hematuria due to the presence of a cystolith in the urinary bladder. The diagnosis of cystolithiasis in this bitch was dependent on various factors which included; clinical signs such as hematuria, radiologic and ultrasonographic findings. In dogs urolithiasis of lower urinary tract is common (Linda *et al*., 2011) with hematuria and dysuria as the most common signs observed. Hematuria occurs because the calculus rubbed constantly against the bladder wall as a result it caused irritation, damaged the tissue and bleeding. Dysuria may result from inflammation and swelling of the bladder walls from muscle spasms, or due to physical obstruction to urine flow caused by the presence of the calculus. Large calculus may act almost like a valve or stopcock, causing an intermittent or partial obstruction at the neck of the bladder. Confirmatory diagnosis of cystolithiasis is done by imaging techniques using radiography and ultrasonography. Bumin and Soylu (2000) suggested that simultaneous examination of dogs using radiography and ultrasonography was helpful for diagnosing cystic calculi. Ultrasonography had a potential value in diagnosing urolithiasis (Voros *et al*., 1992). Survey radiographs showed the presence of a radio-opaque mass located in the bladder, while ultrasound scans revealed hyperechoic mass in the bladder surrounded by anechoic urine. Ultrasound offers a better imaging modality due to the visualization of urinary crystals which cannot be detected on radiologic examination. Struvite calculus was the most common form of urolith in dogs. Struvite calculus in dogs is primarily linked to urinary tract infections. The short urethra of female animals predisposes them to urinary tract infections; an increased incidence of struvite calculus is therefore to be expected in the bitch (Beavon and Heatley, 1962). The choice of surgical management was arrived at based on the size of the calculus. Cystotomy to remove the calculus is recommended for large calculus in females which cannot be dissolved by medical management.

Conclusion

Imaging techniques like ultrasonography, X-ray are safe and non-invasive diagnostic techniques which allows visualization of bladder calculi and bladder crystals. Routine examination of the urinary bladder allows detection of early crystal formation prior to their aggregation to form calculi and thus allow for early medical management of the condition.

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