



OBSTRUCTIVE UROLITHIASIS IN DOGS: ADVANCES IN DIAGNOSIS AND MANAGEMENT

Sarada Amma .T¹, Sheeja, V.M.², Rajankutty.K³, John Martin K.D⁴ and Usha N.Pillai.⁵

Department of Veterinary Surgery and Radiology,
College of Veterinary and Animal Sciences, Mannuthy, Thrissur
Kerala Veterinary and Animal Sciences University

The urinary system is designed to dispose off the metabolic waste products in soluble form. Some of these waste products are sparingly soluble and occasionally precipitate out of solution to form crystals. Urolithiasis is such formation of crystals/calculi from less soluble crystalloids of urine. Such crystals/ small concretions formed become lodged anywhere in the urinary system and may grow to sufficient size/accumulate to cause clinical signs.

INCIDENCE.

Urolithiasis is a very common condition met with in dogs and almost all breeds are affected. Majority of the breeds affected are Labrador Retrievers, German Shepherd Dogs, Dachshunds, Boxers and Pomeranians. Even though incidences in puppies were reported most of the dogs affected were between 4 to 8 years of age. Male dogs are more affected than females.

Site of occurrence

Calculi may form any where in the urinary system. In dogs lower urinary tract obstructions are more common affecting the urethra. Lodging of the calculi are most often encountered in the groove of os penis and behind the level of os penis and at bladder neck. Obstruction due to accumulation of calculi through out the length of urethra is also observed. . Nephroliths are calculi formed in the kidney, and ureteroliths in the ureter.

Size and shape of calculi varies . Small crystals to large single or multiple calculi are noticed. Large calculi may remain in the bladder with out causing any clinical signs. Small calculi/ gravels in the bladder are causing more clinical signs as it often migrate into urethra and gradually accumulate and lead to partial/complete obstruction to urine flow.

Composition of of calculi

The composition of calculi consisted of Magnesium ammonium phosphate (Struvite), Calcium oxalate (Monohydrate, Dihydrate), Calcium hydrogen phosphate dihydrate (Brushite), carbonate apatite, Urates, Calcium phosphate (Hydroxy apatite), Ammonium acid urates, Uric acid, Cystine, Silica, Matrix, Mixed types. The most common types of calculi encountered in dogs are magnesium ammonium phosphate, ammonium acid urate, calcium oxalate and Cystine. Less common types of calculi encountered in dogs include calcium phosphate, silica, sodium acid urate, carbonate, xanthine

ETIOPATHOGENESIS

Understanding the etiopathogenesis of Urolithiasis is an essential pre-requisite for therapy and prevention of calculi.

Initiation and growth

The initial step in the development of uroliths is the formation of a crystal nidus. It depends upon the super saturation of urine with calculogenic crystalloids and may be influenced by magnitude of renal excretion of the crystalloid, urine pH and crystallization inhibition in urine. Further growth of the crystal nidus depends on its ability to remain in the urinary system, the degree and duration of super saturation of the urine with crystalloids, identical or different from that of the nidus.

There are several factors, usually working in combination that lead to urolith formation. Inadequate water intake, consumption of hard water, diet rich in protein, minerals, infection of the urinary system, excess medication leading to variation in urine pH and

¹Professor and Head,² M.V.Sc Scholar, ³ Professor

⁴Associate Professor, Dept.of Surgery and Radiology, CV& AS, Mannuthy

⁵ Associate professor, Veterinary Clinical Medicine and Jurisprudence



prolonged use of calcium and other mineral supplements etc. are the major causes.

Urinary tract infections.

Streptococcus, Staphylococci and proteus and E.coli species are common micro organisms encountered. Staphylococci and proteus species are potent urease producer hence they are commonly associated with struvite urolith in dogs. Staphylococci also produce phosphatase in addition to urease. Bacterial phosphatase might increase the concentrations of inorganic phosphorus by action on organic phosphates.

The solubility of struvite decreases in alkaline urine. Conversion of urea to ammonia as a result of bacterial urease appears to be important in causing urine to become super saturated with magnesium ammonium phosphate as well as calcium phosphate and carbonate apatite crystals. Urease produced by bacteria increases alkalisation of urine and favours formation of ammonia and carbon dioxide and subsequently carbonate apatite crystals. Both urea and urease are required for alkalisation, super saturation and subsequent precipitation of struvite (Magnesium ammonium phosphate hexahydrate) crystals.

Urine pH.

Normally dogs and cats have an acidic urine. Renal tubular acidosis, consumption of diet that reduces production of acid catabolite and/or prolongation of the post prandial alkaline tide leading to a persistent increase in urine pH.

Genetic

The high incidence of struvite urolith in some breeds of dogs such as miniature schnauzers suggests a familiar tendency.

Disease

One of the many consequences of this disease called Porto-systemic shunts (PSS) is the formation of ammonium urate bladder stones.

Medications

Medications that increase or decrease the pH of the urine can also set the stage for stone formation. Some medications can cause formation of stones when used for a long period. Sometimes by increasing the calcium level in the urine.

Mineral crystals

Urine that is saturated with excess amount of certain minerals are prone to form bladder stones. These minerals commonly include magnesium, phosphorus, calcium and ammonia. Most stones consist of an organic matrix of protein surrounded by crystalline minerals.

CLINICAL SYMPTOMS

Typical symptoms include dribbling of urine, straining to urinate (stranguria), blood in the urine (hematuria), urinating small amounts frequently (pollakiuria) and distension of urinary bladder. In cystolithiasis there may be polyuria. Some pets can have bladder stones without any apparent symptoms at all. Soiling of the perineal region due to frequent urination is the typical symptom in female dogs. Bladder distension is not seen unless urethra is obstructed. The calculi in the bladder can be palpated. Distension of bladder on palpation is the apparent sign in complete obstruction of the urethra.

DIAGNOSIS

Based on the history and clinical symptoms. Radiography and ultrasound scanning are used for confirmation to locate the site of occurrence of uroliths. Most of the bladder stones are palpable. Urine analysis and Urine culture reveals the presence of calculi and infection if any. Qualitative analysis provides the most definite diagnosis, prognostic and therapeutic information.

Urinalysis.

A urine analysis is crucial in making a correct diagnosis. The pH of the urine and the presence of blood, pus cells bacteria, crystals and protein provide valuable information.

Urine culture and sensitivity test:

Culturing the urine will reveal the type of infection involved, and to select effective antibiotics.

Qualitative analysis: Chemical analysis of urine sample and calculi.

Quantitative analysis

In contrast to chemical methods of analysis physical methods have been proven to be superior



in the identification of crystalline substances. Physical methods commonly used by lab include combination of polarizing light microscopy, X-ray diffractometry and IR spectroscopy.

THERAPY

Therapy of Urolithiasis encompasses the relief of obstruction by cystocentesis, elimination of existing calculi by medical/surgical means, eradication or control of urinary tract infection and prevention of recurrence of urolith and treatment for concurrent diseases.

Medical dissolution of calculi

The objectives of medical management of uroliths are to arrest further urolith growth and to promote urolith dissolution by correcting or controlling underlying abnormalities for therapy to be effective. Useful in partial obstruction and to prevent recurrence.

1. Increasing the volume of urine in which crystalloids are dissolved or suspended to eliminate along with urine
2. Inducing under saturation of urine by increasing the solubility of crystalloids in urine. (Administration of medication and to change urine pH to create an environment less favourable for crystallization.)
3. Reducing the quantity of calculogenic crystalloids in urine. It includes changes in diet, administration of allopurinol to decrease the amount of uric acid formed, and administration of cellulose phosphate to minimize intestinal absorption of calcium.
4. Medication to inhibit urease production by micro organisms. Acetohydroxamic acid (AHA) @ 25mg/kg in divided doses was found effective for struvite calculi.
5. Use of hydrochlorothiazide @ 4-8 mg/kg in divided doses are found effective in reducing calcium excretion and used in calcium oxalate.
6. Allopurinol at a dose rate of 30 mg/kg for one month and later at dose rate of 10mg/kg for next month for urate stones.
7. Dissolution of calculi (Struvite) in the urethra and bladder with calculolytic buffer solution

(Walpole's solution) by infusing through the catheter inserted close to the obstructing calculi has been reported. Repeated attempts are required.

SURGICAL TREATMENT

In complete obstruction of urethra decompression of the bladder is an emergency by cystocentesis, urethrotomy / cystotomy. Removal of obstructing calculi according to the region affected are to be carried out. The site and technique depends upon the location of the block and the condition of the patient. Usually dogs are presented with urethral blockage and treatment consisted of urethrotomy and or cystotomy. For calculi in kidney nephrotomy, pyelolithotomy, lithotripsy, US fragmentation (lithotripsy) are employed.

Prevention of recurrent Urolithiasis

Calculi of all types have a tendency to recur following their surgical removal or medical dissolution. Recurrence may be related to (1) Persistence of underlying causes of Urolithiasis (2) Failure to remove all uroliths from urinary tract especially small calculi (3) Persistence of UTI with urease producing bacteria (4) Lack of owner or patient compliance with therapeutic or prophylactic recommendations (5) Prolonged use of medications.

Management includes:

1. Increasing urine volume: Provide adequate fluid intake. Administration of diuretics. The primary reason for the use of the diuretic is that, it dilutes the urine, and flush out the tract and decreases the urinary excretion of calcium. However it also increases the urinary excretion of magnesium.
2. The eradication or control of infection of the urinary tract caused by urease producing bacteria is the most important factor for preventing the recurrence of most infection. If recurrent UTI persists in definite therapy with prophylactic doses of antimicrobial agents that are eliminated in urine in high concentration is indicated. These agents include flouoroquinolone, nitrofurantoin, ampicillin, and nalidixic acid and chloramphenicol. Maintain urine pH.
3. Supplementary therapy with potassium citrate will be of useful in calcium oxalate Urolithiasis.



4. Diet management. Reduce protein content, leafy vegetables, tomato etc in the feed.

CONCLUSION

Urolithiasis is frequently met with in canine patients. Animals are presented with history of oliguria, difficulty in urination or haematuria. Diagnosis is made by observing clinical symptoms and is confirmed by radiography/Ultrasound scanning.

Treatment is successful if attended in early stage itself. Surgical treatment is more effective. It includes decompression of the bladder by cystocentesis, urethrotomy cystotomy, lithotripsy according to the location of obstruction and removal of calculi.

Medical treatment includes adequate fluid administration for dilution and elimination of crystals, use of calculolytic drugs, altering pH of urine, altering diet, if necessary and suitable antibiotics to prevent urease production and infection are useful in incomplete block but requires long-term medication to prevent recurrence also.

Recurrence can be prevented by diuretics, suitable antibiotics, altering pH of urine and diet management

REFERENCES

- Abdullahi, S.U and Adeyanju, J.B.(1987). Medical dissolution of ammonium urate uroliths in a dog. *Mod. Vet. Pract.* **20**: 438
- Damodaran, R (2004). Evaluation and Management of Urolithiasis in Dogs. M.V.Sc. Thesis submitted to Kerala Agricultural University, Vellanikkara, Thrissur.p.99
- Dowling, M.P.(1996). Anti microbial therapy of urinary tract infections. *Can. Vet.J.* **37**:438-441.
- Gourley, I.M., Vasseur P.B., (1998). General Small Animal Surgery, J.B Lippincott Company, Philadelphia, 574-612.
- Hoff, M.E.(1986). Dietary management of struvite cystic calculi in a dog. *Mod. Vet. Pract.* **90**: 883-886
- Ling, G.V., Franti, C.E., Ruby, A.L and Johnson, D.L(1998) Urolithiasis in dogs II Breed prevalence and interrelations of breed, sex, age and mineral composition. *Am.J.Vet.Res.* **59**(5):624-629
- Janke, J.J., Osterstock, J.B., Wasburn, K.E., Bissett, W.T., Russel Jr. A.J and Hooper, R.N.(2009). Use of Walpole's solution for treatment of goats with Urolithiasis. *J.Am.Vet.Med.Assoc.* **234**: 249-252
- Ling, G.V., Franti, C.E., Johnson, D.L and Ruby, A.L (1998). Urolithiasis in Dogs. III: Prevalence of urinary tract infection, age, sex and mineral composition. *Am. J. Vet. Res.* **59**: 650-660
- Markwell, P.J. and Stevenson, A.E.(2000). Nutritional management of canine Urolithiasis. *Advances in clinical nutrition Waltham Focus. Spl.Ed.* 43-47.
- Shaw, D.H.(1990) A systematic approach to managing lower urinary tract infections. *Vet. Med.* **91**:379-386
- Sheeja, V.M.(2008) Radiographic evaluation and management of lower urinary tract disorders in dogs. M.V.Sc. Thesis submitted to Kerala Agricultural University, Vellanikkara, Thrissur.p.130
- Voros, K., Wladar, S., Varbley, Tand Fenyés B.(1993). Ultrasonographic diagnosis of urinary bladder calculi in dogs. *Canine Pract.* **18**:29-33