Epidemiologic, Clinic and Ethiopathogenic Studies in Canine Urolithiasis

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Abstract: In a study performed on 983 examined dogs, urolithiasis was diagnosed in 20 cases, representing 2.03%. The highest incidence of urolithiasis was registered at the pure breeds (80%), most of them represented by males (75%). In the order of their appearance, the major symptoms for which the owners requested veterinary consult, were: anuria or dysuria (55%), bloody urine (40%), depression (40%), polakysuria (30%), stranguria (25%), urinary incontinence (15%). Using the ultrasound technique, we identified sediments in the urinary bladder in 80% of the dogs, uroliths in 20% (3 cases) and nephroliths in one case. Most of the encountered crystals were struvites (80%), cystine (10%), calcium oxalate (5%) and calcium phosphate (5%). Urolithiasis and sediment formation was found secondary to: urinary infections in 40% of the patients, chronic renal diseases in 25%, hyperproteic diet (20%), inborn errors of metabolism (10%) and diabetes mellitus (5%).

INTRODUCTION

Canine urolithiasis can be defined as a disease caused by the interruption of urinary flow due to mineral collections of different sizes (microliths, macroliths) or organic collections (blood clots, fibrin deposits). The last ones develop, in most of the cases, due to the mechanic and irritative action of the mineral collections, referred as uroliths.

The uroliths, as well as the organic collections, can develop and localize anywhere in the urinary tract. As for the effects of these collections on the well functioning of the urinary system, it is widely accepted that, regardless of the localization of uroliths, they have an immediate or delayed negative impact.

The most frequent localizations are in the low urinary tract: urinary bladder, 93% in females and 79% in males, meanwhile in the kidneys and urethers the percentage is of 4% in females and 2% in males. [7].

The detection of uroliths is not the final diagnosis, but only the beginning of a long list of investigations, with the final aim of elucidating the most accuate ethiology. It is essential to know the etiopathogenic circumstances of sedimentosis and urolithiasis, in order to modulate an efficient therapy and most of all to elaborate a special diet and hygienic condition. The final purpose is to exclude recurrent urolithiasis.

MATERIAL AND METHOD

The studies were performed at the Medical Pathology Clinic of the Faculty of Veterinary Medicine, Cluj-Napoca and at the S.C. Salvet S.R.L. Veterinary Office, between April 2005 and April 2006, on 20 dogs diagnosed with urolithiasis from the amount of 983 cases.

In the investigation of the patients and establishment of the diagnosis the following methods were used: patient’s history, clinical and paraclinical examinations (urine analysis...
and ultrasonography). The laboratory analysis of the urine consisted of physical (density, organized and unorganized sediment) and chemical examination (pH, proteinuria).

RESULTS AND DISCUSSIONS

The results of the epidemiological study performed between April 2005 and April 2006 reveal that, from 983 investigated dogs, urolithiasis was diagnosed at 20 patients, representing an incidence of 2.03%. Among these, 16 dogs were of pure breeds (Boxer, German Sheperd, Cocker Spaniel, Dalmatian, Dobermann, Pekingese, Pinscher, Rottweiller) and 4 were of mixed breeds or cross-breed dogs.

The age of the affected dogs varied between 11 months and 17 years, the incidence of the disease growing in dogs over 2 years. It reaches the highest values in the category of 7-10 years.

According to the sex of the patients, the incidence of urolithiasis was 75% in males (15 cases) and 25% in females (5 cases).

The diet of the dogs diagnosed with urolithiasis consisted of:

- only home made food in 10% of the patients (2 cases);
- only commercial food (dry dog food, canned food) in 35% of the patients (7 cases);
- mixed food, home made combined with commercial food in 50% of the patients (10 cases);
- remnant food from canteens in 5% of the patients (1 case);

The main reasons for requesting veterinary consult were (in descending order of appearance): impossibility or difficulty in micturition (11 patients), hematuria (8 patients), frequent urination and in small amounts (6 patients), micturition in thin streams or drops (5 patients), uncontrolled micturition in the day but also in the night (3 patients). The overall history was fitting in all the cases with the major symptoms identified at the clinical examination.

The clinical signs described above suggest that urolithiasis occurred due to different ethiopathogenic circumstances. Thus, the low urinary tract infections, primary or secondary to urinary bladder and prostate neoplasms (diagnosed by ultrasound), induced urolithiasis with struvites in 8 patients, representing an overall of 40% in the affected dogs.

The intense albuminuria and uremia associated to some chronic nephropathies were certainly the cause of the alkalinization of the urine in 5 patients (25%). To these umoral abnormalities a hyperphosphaturia associated to the chronic uremia (5) was registered, which induced the formation of magnesium-ammonium-phosphate crystals in the urine (struvitis) in 4 patients and calcium phosphate in 1 patient. In 4 patients (20%) no signs of bacterial infection of the urinary tract were detected.

In conclusion, the urine alkalinization and urolith or crystal formation had a preliminary nutritional origine.

In one case (5%) was diagnosed urolythiasis with calcium oxalate, when diabetes mellitus was concurrent. Urolithiasis with cystine, as a consequence of a hereditary deficiency in cystine’s tubular reabsorption and excretion, was diagnosed in 2 cases (10%).

Regarding the identified crystal types from the urine of the examined patients, we observed a concludent dominancy of the magnesium-ammonium-phosphate crystals (80%). The cystine crystals identified in the urinary sediments of 2 patients (10%), one of them having at the same time crystaluria with magnesium-ammonium-phosphate crystals. One patient (5%) was identified with calcium oxalate and the other with calcium phosphate crystals (5%).
From the 20 patients, 4 dogs (20%) presented, besides crystaluria, different sizes of urinary stones, meanwhile the rest of them (80%) had only crystals. The localization of the stones was exclusively in the urinary bladder (urocystoliths) in 3 dogs, meanwhile in a male Dalmatian calculus was diagnosed in the urinary bladder and the basinet of the left kidney (nephroliths).

At clinical examination of the urine the density was variable between 1020 and over 1030. Thus, in 20% of the patients, the density had values between 1020 and 1025. The density of 1030 was registered in 4 patients (20%), and the rest of 12, representing 60%, had the density over 1030.

After the obtained results in this study, a first important fact is that the incidence of urolithiasis in the examined dogs was of 2,03%. This value is quiet close to those mentioned by other authors from the United States (2,8% - [2] and 0,53% - [10]). In Europe, urolithiasis is mentioned with an incidence of 0,5-1% in Germany and 0,23% in Sweden [6, 13].

Eventhough in the present study urolithiasis was present mostly (80%) at the pure breeds, the small amount of cases didn’t permit to estimate the predisposition of a certain breed in this type of affection. But, the breed predisposition regarding urolithiasis with cystine was confirmed in this study. So, this anomaly in cystine metabolism was diagnosed in one 4 years old Pinscher male. The susceptibility of this breed for urolithiasis with cystine it’s a notorious fact, in this field existing many acknowledgments and clinical studies [1, 3, 14].

But, it was observed that the highest incidence of the disease (50%) was associated with the use in the dogs’ diet of home made food mixed with commercially available dry food. In conclusion, the local theory about the benefic influence of the home made food mixed with dry food, due to various and complete components, must be reconsidered in the prevention of urolithiasis.

The increase incidence of urolithiasis at the aged dogs, observed in our study, is in concordance with the results obtained by other authors [9, 11].

Regarding the clinically observed predominance of urolithiasis in the male patients (75%) compared to the females (25%), it should depend on the anatomic features of the urethra. Thus, if in the females the urethra conformation permits the elimination of some urocystoliths, this phenomenon is incomparably much rare in the males. A close percentage was mentioned by Sosnar et al. [12], in the period between 1997-2002.

The functional disturbances induced by the uroliths in the males can be sometimes impressive, culminating with urethra obstruction, which produces acute uremia, as observed in 2 cases. This is the reason why urolithiasis has less dramatic consequences in females compared with males, fact that determines the need for a veterinary consult. Thus, it is logical to presume that the number of male patients diagnosed with urolithiasis must be higher than that of the females. So, at least in our study, we consider the high predisposition of males to urolithiasis as being relative.

Clinical signs observed in the examined patients were quiet specific to urolithiasis, although the history information weren’t always suggestive. These data were just informative for the following investigations, especially when the mentioned symptoms showed a low urinary tract disease. But, in the studied cases, the obtained information were never typical for urolithiasis.

Thus, in the studied cases with struvite urolithiasis we could assign two major causes which induced the disease. The first one, most frequently occured, consisted of the infections of the low urinary tract with consecutive urine alkalinization. The alkalinization of the urine, an essential condition in inducing the magnesium-ammonium-phosphat crystal formation, is
always the consequence of the producing bacterial flora involvement with urease activity [2, 7, 8].
In the cases without bacterial involvement, urolithiasis with struvites had a dismetabolic origin. Thus, the second major cause implied in the magnesium-ammonium-phosphat crystal formation was represented by the nutritional protein excess from the high or exclusive meat diet.

It is well known the urine alkalinization effect of the hiperpoteic diet. [9]. Frequently, this condition induced chronic nephropathies with massive albuminuria consequences. The detected albuminuria in these patients, together with the hiperpoteic diet, were determinative factors in urine alkalinization.

The formation of calcium oxalate crystals was noticed in one patient with clinical and umoral symptoms of diabetes mellitus. Oxaluria may develop secondary in patients suffering of this dismetaboloy [5].

Urolithiasis with cystine crystals, diagnosed in the Pinscher male, evaluated infraclinically for a long period. It was diagnosed when urethral obstruction occurred due to the accidentally engagement of an urocystolith. Because there were only cystine crystals in the urine of this patient, we accepted that the calculi recovered from the urinary bladder after cystotomy was dominated by cystine. Certainly, to establish their definitive structure, we need to elucidate the chemical composition, because there are many acknowledgements regarding a mixed composition of the calculi. Thus, there are mentioned cases with uroliths consisted of a cystine internal layer surrounded by successive external layers of struvites [4]. Otherwise, in the second case of cystine urolithiasis existed at the same time struvite crystals, fact that demonstrates that these two crystal types can coexist from the beginning. So the formation of small uroliths, without a strict stratification of cystine and struvite, is possible. This fact underlines once more the need to determine the chemical composition of calculi, even if we identify at the same patient uroliths and crystals too.

Surprisingly, in one patient, the struvite urolithiasis occurred in the kidney and in the bladder, too. Interesting is the fact that the localization of the nephrolith was unilateral (in the left kidney), although their causative factors didn’t omit the right kidney, at least theoretically. A possible explanation would be a latent unilateral renal infection responsible for the induction of those modified mucoproteins, which promote the precipitation of struvite crystals. In conclusion, it is indisputable the role of urinary pH variations in the urinary infections and anomalies in the excessive excretion of some intermediar metabolic products as cystine. Beside these essential conditions in the urolith synthesis, many authors underline the role of urine concentration with lythogenic crystals [10, 11]. These will increase the urine density to hyperstenuria. A condition like this was obvious in the present study by the fact that the incidence of urolithiasis increased direct proportionally with the urinary density.

The results obtained during the researches on the 20 dogs with urolithiasis, underline the fact that this disease has a polyfactorial ethiology. This includes the compulsory physico-chemical changings of the urine (density, pH) and optionally some hereditary disfunctions in the physiological mechanisms of the reabsorbtion of some intermediar metabolic products.

The acceptance of the polyfactorial ethiology in canine urolithiasis and the known information about the causative factors of uroliths, are the basis of a rational preventive and curative programme elaboration in this disease.
CONCLUSIONS

- The incidence of urolithiasis at the 983 patients examined between April 2005 and April 2006 was of 2.03% (20 cases), 16 being of unmixed breeds (80%) and 4 of mixed breeds or cross-breed dogs (20%)
- The number of urolithiasis cases grew proportionally with age, reaching the maximum in dogs between 7-10 years. Compared with the females (25%), the most affected were males (75%)
- Mixed food (home made food and commercially available dry food) was associated with the highest incidence of urolithiasis (50%), compared with unilateral food (home made food 10% or dry food 35%)
- The increase of incidence in urolithiasis and sediment formation was directly proportional with the increase of urine density.
- The primary causes that induced urolithiasis were the urinary infections (40%), chronic renal diseases (25%), hyperprotheic diet (20%), inborn errors of metabolism (10%) and diabetes mellitus (5%)
- Crystal type hierarchy involved in urolithiasis demonstrate the predominance of the magnesium-ammonium-phosphate crystals (80%), followed by cystine (10%), calcium oxalate (5%) and calcium phosphate (5%)
- Crystaluria and the crystal collections were seen in 80% of the patients, meanwhile the urocystoliths and nephroliths affected 20% of the patients
- The uroliths were situated in the urinary bladder (3 cases) and unilaterally in the renal basinet (1 case)

BIBLIOGRAPHY