THE NUTRITIONAL IMPACT UPON THE DEVELOPMENT AND TREATMENT OF THE PHOSPHATE-AMMONIUM-MAGNESIUM UROLITHIASIS

Adrian Maximilian MACRI, , Andrei SZAKACS, Antonia ȘTEFĂNACHE, Sorana DAINA
University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine, 3-5 Calea Mănăştur street., 400372, Cluj-Napoca, Romania
adimacri@yahoo.com

Abstract
The urolithiasis in cats represent 15% of the total cases with UTD (Urinary Tract Disease) to this species. Out of these, 50% are proving to be composed of phosphate ions, ammonium and magnesium. To date, a multitude of factors that could be leading to the development of this stones are known. However, their treatment and control still representes a medical challenge. The study has been done on a number of 8 cats, 4 castrated males, 2 intact males and 2 sterilised female. The impact of the food that had been fed to the subjects had upon the development of the phosphate-ammonium-magnesium uroliths, as well as the impact of the post-diagnose diet, had been carefully analysed. As a result, the excess of 5 risk factors in the struvite lithogenesis from their daily diet before the diagnosis. Their values had been compared with those found in the speciality literature for the same risk threshold. From the perspective of this pathology's development, the results have revealed in all eight cases an excess of calculogenic factors in their pre-diagnose diet. However, it did not reveal an influence over the struvite disolution. The next step was to study the treatment's evolution from using two commercialy available products, fomulated for the treatment and prevention of the studied urolithiasis. The results have concluded the efficacy in the complete dissolution of the struvite of just one of them.
Key words*: cats, urolithiasis, struvite, nutrition.*

Introduction

Urolithiasis, sometimes regarded as a nutritional disease, must be seen further as a conglomerate of sequelae of various abnormalities. The principle laying at the basis of this pathology involves the precipitation of mineral substances, soluble in urine, which at macroscopic dimensions will be called uroliths, calculi or stones. The crystallisation of struvites follows several stages that underlie the term lithogenesis, referring to all the processes that led to the formation of uroliths, these being an agglomeration of crystals assembled on an organic matrix. Prior to shaping these uroliths, the formation of crystals of the substances contained in the urine, through a process called crystalline genesis, a pathogenic character lacking process (Bilbault, 2015), is observed. The urine pH influences crystals precipitation and formation of struvites at certain values, which tend to appear and usually persist in a more alkaline urine, above 6.8 (Nelson et al., 2013).

The values of this parameter tend to vary over the course of the day, under the influence of nutrition, feeding time, feeding method, and ingested quantity. Constantly, it is difficult to interpret a single value of urinary pH, especially if the type of food and administration time is unknown. It is also demonstrated that simply transporting cats to the veterinary hospital can increase urine pH (Serre, 2014). The primary process of stones formation is unknown, but an agreement has been reached that involves their interdependence with urine super saturation in phosphorus, magnesium and ammonium (Daudon et al., 2012). Crystals' formation involves a type of activity of the product that reflects the concentration of ions where the precipitation of the solute takes place, a homogeneous nucleation and eventually the formation of crystals, at a given pH and temperature, is the expression of the upper limit of metastability (Hand et al 2010). The second

step leading to increased uroliths depends on the degree and duration of urine saturation and super saturation. Non-crystalline substances in the protein form matrix may also play a role in the nuclear process in some situations. The characteristics of erratic and unpredictable development of uroliths suggest us a complex interaction of factors related to metabolism, anatomy and pathophysiology. From the point of view of the importance of metabolism, it modulates the urinary excretion of phosphorus, magnesium or ammonium, which is reflected by the following stages, which, although complementary, are still separate: germination, growth, aggregation and fixation of the crystals (Daudon et al. 2012). The factors that start these stages may also be different in some situations.

Materials and methods

In this study, cat food history, as a determinant factor, was studied to determine the excesses that led to the formation of phosphate-ammonia-magnesium urolithiasis, but also the predisposing factors (age, race, sex, body condition, and living environment). Also, there was followed the nutritional impact of the recommended post-diagnostic diet, during the period 2017-2018, in the Animal Nutrition discipline, in partnership with the discipline of Medical Pathology and Clinics, at the Faculty of Veterinary Medicine Cluj-Napoca. The biological material consisted of 8 cats, including 4 castrated tomcats, 2 intact and 2 sterilized cats. Each cat was subjected to complete physical examination, giving importance to the hydration status, urinary bladder and external urethral opening. Paraclinic diagnosis included urine summary, translated by urinary biochemistry and urinary sediment examination, urinalysis and abdominal imaging.

From nutritional point of view, the cats taken in the study consumed 6 types of dry food and 4 types of wet food before being diagnosed and after the diagnosis was used the diet A which had in composition: rice, wheat gluten, maize flour, animal fat, corn gluten, minerals, lignocellulose, hydrolyzed animal proteins, fish oil, soybean oil, dried eggs, hydrolyzed crustaceans (source of glucosamine) and diet B containing cereals and animal by- and fats, extracts from vegetable proteins, minerals, acidifying substances (DL-methionine). Uro-pet (Vetoquinol) and UrinoVet have been given as dietary supplements.

Results and discussions: Observations on the nutritional impact on the formation of phosphate-ammonium-magnesium urolithiasis in the 8 patients under study revealed several aspects. The protein has been shown to be the largest parameter in the ration / day of cats studied, except for clinical case 6, which is also the only breed uncovered in the literature as part of the class of predisposing factors in the production of this disease. In the clinical evolution of patients, 5 out of 8 cases had overlapping bacterial infection in the urinary tract, subject to treatment until completion of the study. Observations concerning the nutritional impact on the treatment of phosphate-ammonium-magnesium urolithiasis in the eight patients under study showed that only one of the two variants of nutritional treatment was felt 100% in the dissolution of sterile struvites, uroliths formed following the bacterial infection, and in the complete remission of symptoms in 4 patients, 3 males and one female. This diet was designed as a treatment for struvites dissolution, while diet A is recommended and prophylactic. The diet B mentioned above was the subject of a study by Lulich et al., Published in 2013.

The study was conducted on 32 cats divided into two lots, following the efficacy of this diet (entitled Aa's diet, in this publication) formulated to dissolve phosphate-ammonia-magnesium urolithiasis in cats compared to a diet meant to avoid the occurrence of struvites, respectively to prevent recurrence (Bb). Based on the results obtained at the conclusion of this research, it was

observed that the Aa diet was noticeably more effective in the dissolution of struvites compared to the Bb diet. The findings of the study highlight the fact that the Aa diet produced a more acidic urine in a shorter time compared to the other diet, which took a longer time to show the same results. However, the researchers in the study mentioned the benefit of Bb as a type of food used in the long term, so it is not necessary to introduce a sustained post-dissolution struvite maintenance diet.

The struvites dissolution was performed at a pH of 5-6, this phenomenon being performed with the remission of clinical signs in 4 patients. The length of time that this desideratum occurred was between 79-114 days, in antithesis with patients who underwent dietary treatment for a period of between 52-106 days. One patient (case no. 7), together with switching from pre-diagnosis food to diet A, showed signs of vomiting and diarrhea, which is why it was changed to diet B. Until the study was completed, it was not reached to determine the evolution of recommended diet afterwards.

Conclusions: All patients received food in much higher quantity than that indicated by the producers, or compared to the needs of the body. The values of the cat's food parameters studied, as risk factors, were above the threshold at which struvite urolithiasis may develop, the protein being considered to be the major factor.

The excess of calculogenetic factors in pre-diagnostic cat food did not influence the dissolution of calculi. It is possible to objectively conclude the efficacy of diet B in this condition, and subjectively, besides the content of acidifying substance (DL-methionine), the facts that in its composition the risk factor values are at least half the risk threshold. In antithesis, in diet A, sodium and phosphorus are well above recommended limits, patients undergoing treatment, although showing signs of improvement, did not reach their target by the end of the study. Also, the importance of the water source consumed by patients cannot be ascertained. Some proponents say they adhere to the imposed recommendations, while others recognize "dietary improvement" as well with non-recommended foods. Finally, we can assert that dissolution by dietary treatment of phosphate-ammonium-magnesium uroliths in cats is a safe, efficient, cost-effective method as long as attention is paid to predisposing factors and eliminating the determining ones.

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