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Retrospective of urolithiasis in dogs and cats at the Veterinary Hospital University Brazil – Fernandópolis/State of São Paulo between January 2018 and April 2019

Retrospectiva da urolitíase em cães e gatos no Hospital Veterinário Universidade Brasil – Fernandópolis/SP entre janeiro de 2018 e abril de 2019

Retrospectiva de urolitiasis en perros y gatos en el Hospital Veterinario Universidade Brasil – Fernandópolis/SP entre enero de 2018 y abril de 2019

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Abstract
Urolithiasis is a disorder characterized by the presence of stones in the urinary tract, associated with multifactorial causes. It is frequent in small animals. The objective of the present study is to formulate a profile of the patients affected by this disease and contribute to more accurate diagnoses and more effective therapies, aiming to reduce reoccurrences so common to this disease. The study was carried out via the exploratory analysis of the medical records of patients diagnosed with urolithiasis at the Veterinary Hospital of Universidade Brasil – Fernandópolis Campus, State of São Paulo, between January 2018 and April 2019. Information regarding epidemiology, clinical signs, tests, diagnoses, instituted treatments, and reoccurrences was compiled. Subsequently, the data were analyzed, prevalence was determined, and graphs were elaborated using the Microsoft Office Excel® program. The results revealed a total of 20 animals diagnosed with urolithiasis during the study period, 16 (80%) of which were dogs and four (20%) were cats. It was observed that small dogs, mainly of the Shih-tzu breed, were the most affected, and aspects related to the environment such as home-only experience, sedentary lifestyle and contactants were recurrent. Therefore, for any animal that fits the profile and with consistent symptomatology, urolithiasis should be considered a differential diagnosis.
Keywords: Hematuria; Urinary obstruction; Shih-tzu; Urolith.

Resumo
Urolitíase é um distúrbio caracterizado pela presença de cálculos no trato urinário, associado a causas multifatoriais e frequente em pequenos animais. O presente trabalho teve por objetivo formular um perfil dos pacientes afetados por esta doença e contribuir para diagnósticos mais precisos e terapias mais eficazes, visando reduzir as recidivas tão comuns à esta patologia. O estudo foi realizado por meio da análise exploratória dos prontuários dos pacientes diagnosticados com urolitíase no Hospital Veterinário da Universidade Brasil – campus Fernandópolis, São Paulo, entre janeiro de 2018 a abril de 2019. Foi extraído as informações referentes à epidemiologia, sinais clínicos, exames complementares, diagnósticos, tratamentos instituídos e recidivas. Posteriormente, procedeu-se a análise dos dados, determinação da prevalência e elaboração de gráficos por meio do programa Microsoft Office Excel®. Os resultados obtidos revelaram um total de 20 animais diagnosticados com urolitíase no período de estudo, sendo que 16 (80%) destes eram cães e quatro (20%) eram felinos. Foi observado que os cães de pequeno porte, principalmente da raça Shih-tzu, foram os mais acometidos, e aspectos relacionados ao ambiente como vivência somente intradomiciliar, sedentarismo e contactantes foram recorrentes. Logo, para qualquer animal que se enquadre no perfil e com sintomatologia condizente, a urolitíase deve ser considerada um diagnóstico diferencial.
Palavras-chave: Hematúria; Obstrução urinária; Shih-tzu; Urólito.

Resumen
La urolitiasis es un trastorno caracterizado por la presencia de cálculos en el tracto urinario, asociado a causas multifactoriales y frecuente en pequeños animales. El presente trabajo tuvo como objetivo formular un perfil de pacientes afectados por esta enfermedad y contribuir a diagnósticos más precisos y terapias más efectivas, con el objetivo de reducir las recurrencias tan comunes a esta patología. El estudio se realizó a través de un análisis exploratorio de las historias clínicas de pacientes con diagnóstico de urolitiasis en el Hospital Veterinario de la Universidade Brasil - campus Fernandópolis, São Paulo, entre enero de 2018 y abril de 2019. Se extrajo información sobre epidemiología, signos clínicos, exámenes complementarios, diagnósticos, tratamientos instaurados y recaídas. Posteriormente se analizaron los datos, se determinó la prevalencia y se elaboraron gráficos con el programa Microsoft Office Excel®. Los resultados obtenidos revelaron un total de 20 animales diagnosticados de urolitiasis durante el periodo de estudio, de los cuales 16 (80%) eran perros y cuatro (20%) felinos. Se observó que los perros pequeños, principalmente de la raza Shih-tzu, fueron los más afectados, siendo recurrentes los aspectos relacionados con el medio ambiente como vivir solo en el interior, el sedentarismo y el contacto. Por tanto, para cualquier animal que encaje en el perfil y con la sintomatología correspondiente, la urolitiasis debe considerarse un diagnóstico diferencial.
Palabras clave: Hematuria; Obstrucción urinaria; Shih-tzu; Urolito.

1. Introduction

Urolithiasis is the presence of stones in the kidney, ureter, urinary bladder, urethra, and most commonly in the bladder (Rick et al., 2017). It is the main cause of lower urinary tract obstruction in dogs and cats (Carciofi & Jeremias, 2010; Coelho, Monteiro & Von Ancken, 2018), and represents 0.4 to 2% of the attendances in veterinary hospitals (Oyafuso et al., 2010). Uroliths are formed when urine is supersaturated and low-solubility crystals precipitate (Silva et al., 2015; Caldeira, De Assis, Pereira & De Camargo, 2016).

The most prevailing uroliths are those made of struvite and calcium oxalate (Oyafuso, 2008). In dogs, struvite stones are associated with urinary tract infection, being more frequent in bitches than in males (Cruces, Patelli, Tashima & Mello-Peixoto, 2013). The sterile form predominates in cats (Costa, 2009) and the precipitation of struvite crystals contributes to the formation of "plugs" that can cause obstructions (Martins et al., 2013). The calcium oxalate stones are related to hypercalciuria and its triggering factors, such as increased intestinal calcium absorption and use of calciuretic substances, being more common in males (Rick et al., 2017; Mendóza-López, Del-Angel-Caraza, Ake-Chiñas, Quijano-Hernandez & Barbosa-Mireles, 2019). Besides these factors, urolithiasis is also influenced by other aspects, such as breed, water intake, diets, and drugs, which makes it a multifactorial disease (Silva et al., 2015).

The clinical signs vary according to the location, size, and number of uroliths. The most reported are frequency, stranguria, dysuria, and hematuria (Nelson & Couto, 2015). The diagnosis is made by means of anamnesis, physical examination, and complementary tests, such as urinalysis, radiography, and ultrasound analysis (Carciofi & Jeremias, 2010; Oyafuso et al., 2010). It can be treated by clinical methods, such as therapeutic diets and drug therapy, which aid the dissolution and/or interruption of the urolith growth, surgery, or a combination of them (Silva et al., 2015).

Thus, this condition can be considered multifactorial, which attests the importance of knowing the characteristics inherent to each type of urolith, to secure efficient treatment and management, aiming to provide a better quality of life for the patient (Caldeira et al., 2016). This study assesses urolithiasis affecting dogs and cats treated in the Veterinary Hospital of Universidade Brasil – Campus Fernandópolis/State of São Paulo, contributing with information for the detection of the disease patterns.

2. Methodology

The present work presents a quantitative approach (Gravetter and Wallnav, 2015) based on data obtained from cases of treatment of animals with specific diseases. A qualitative and theoretical-empirical approach to the means of investigation was also used. And to enable the execution of this purpose, the research worked with technical procedure "survey", according

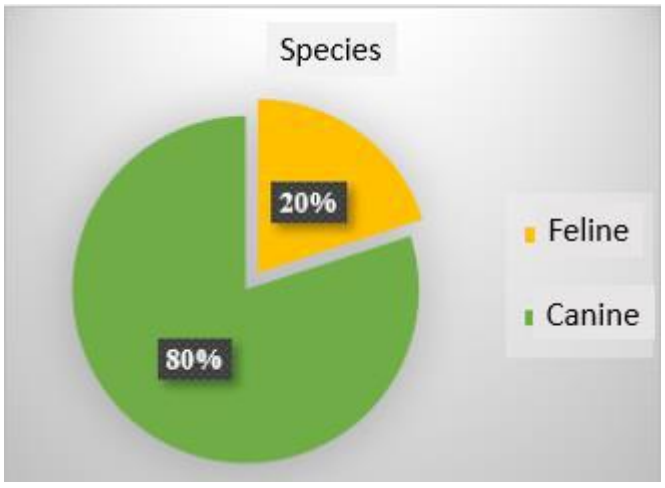
to Gil (2002, p. 50) this procedure involves the direct interrogation of people whose behavior one wishes to know. Basically, information is requested from a significant group of people about the problem studied, and then, through analysis of the answers through tabulation and interpretation, obtain conclusions corresponding to the collected data.

This study was carried out in the Veterinary Hospital of Universidade Brasil – Fernandópolis Campus / State of São Paulo, by means of the exploratory analysis of data obtained from patient's records. A total of 20 animals, comprising 16 dogs and four cats diagnosed with urolithiasis from January 2018 to April 2019 were selected. The information extracted from the patient's records included: gender, breed, age, city of origin, type of food and water intake, previous use of medications, and environment (presence of other animals/distribution of water fountains where these animals live). The parameters analyzed in this study were: clinical signs; results obtained from complementary tests (complete blood tests, kidney biochemistry, urinalysis, urolith analysis, ultrasounds); diagnoses, and instituted and recurrent treatments. To guide this analysis, a questionnaire was previously prepared (Appendix A). With the data thus obtained, the prevalence was determined, and graphs were drawn using software Microsoft Office Excel®.

3. Results and Discussion (can be separated or together) (TNR font 12 – left aligned)

During January 2018 and April 2019, 20 animals were diagnosed with urolithiasis, comprising 16 (80%) dogs and four (20%) cats as can be seen in the Species chart shown in Figure 1. Dogs were predominant in this study (80%), fact that is justified because this is the tutors' favorite species and, consequently, more frequently taken to the hospital sector for small animals. According to the Health Secretariat of the State of São Paulo (Secretaria de Estado de Saúde de São Paulo), the dog population was estimated to be five million in 2018, whereas of cats was a little more than a million (Saúde, 2018).

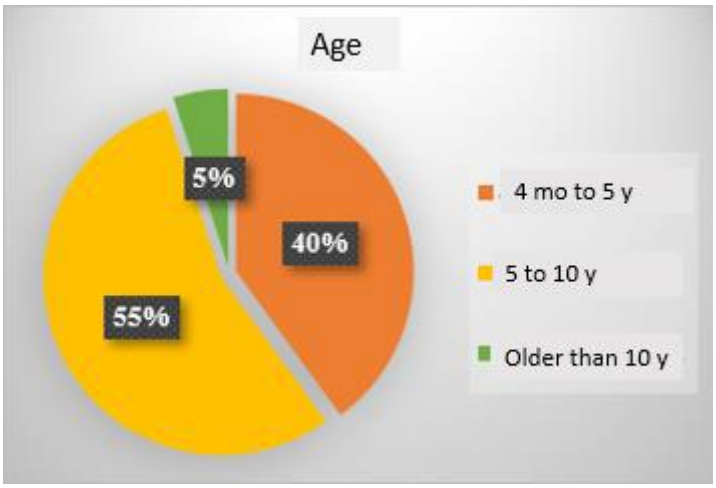
Figure 1. Percentage of species.



Source: Author's archive.

These animals came from nine cities located in the Fernandópolis region – State of São Paulo, with the largest number of affected animals' juveniles or adults, with eight animals (40%) were 4 months to 5 years old, 11 (55%) between 5 and 10 years old, and one (5%) older than 10 years (Figure 2).

Figure 2. Age distribution.



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The geographic region was pointed as factor inherent to the occurrence of urolithiasis in dogs by Mendóza-López et al. (2019). However, Ayusso and Schor (2001), in their study of kidney stones in humans, proposed that people who live in hot regions have reduced urinary volume due to the excessive loss of body fluids and the non-proportional reposition of such losses, being humans more prone to kidney lithiasis. Such theory can be applied to animals that live alongside humans, once their physiologies are similar and withstand high temperatures, such as those of the study area. Therefore, the tutors were informed on the importance of stimulating water intake by their dogs and cats, affected or not by urolithiasis, to avoid urolithiasis reoccurrences and to promote a better quality of life for these animals.

The most affected ages were from 5 to 10 years (55%), which agrees with the mean age of 8 years obtained by Mendóza-López et al. (2019), when studying dogs affected by urolithiasis in Mexico. Pimenta, Júnior, Freitas, Cassiano and Camozzi (2013) obtained a mean age of 7 years for affected cats of ages varying from 5 to 11 years in Brazil. The increase of life expectancy along the last decades and consequently aging of the companion animals, mainly small breeds, is also suggested as a predisposing factor to urolithiasis (Houston, Weese, Vanstone, Moore & Weese, 2017).

Concerning the dogs of our study, 11 (69%) were bitches and five (31%) males. Regarding breeds, 44 % (seven) were Shih-tzu, 25% (4) were unidentified, 6.2% (one) Basset hound, 6.2% (one) Lhasa-apso, 6.2% (one) Pinscher, 6.2% (one) Pug, and 6.2% (one) Rottweiler (Table 1). In relation to cats, 75% (three) were male and 25% (one) female of unidentified breed.

Table 1. Distribution of dog breeds.

Breed	Number of affected animals	%
Shih-tzu	7	44%
*Unidentified breed	4	25%
Basset hound	1	6.20%
Lhasa-apso	1	6.20%
Pinscher	1	6.20%
Pug	1	6.20%
Rottweiler	1	6.20%
Total	16	100%

Source: Author's archive.

Regarding gender, females predominate (69%), and this information correlates with the results obtained when analyzing urolith compositions, revealing the presence of struvite in the seven cases analyzed in this study (Inkelmann et al., 2012). Struvite was found isolated (three cases) or combined with other minerals, such as carbonate and calcium oxalate (four cases). Similar results were reported by Oyafuso et al. (2010), who observed the presence of struvite in simple uroliths, in all mixed uroliths, and predominating in compound uroliths. Struvite stones in dogs are known to be associated with infections, being more common in bitches because of the anatomical particularities of the urinary tract, such as shorter and wider urethra (Syme, 2012).

According to Rick et al. (2017), the incidence of urolithiasis in cats is independent of the gender, but clinical manifestations differ. In this study, three male cats were affected (75%), two by dysuria and one by iscuria, which are clinical signs compatible with obstructive scenarios common in the species (Costa, 2009) and more perceptible by their tutors.

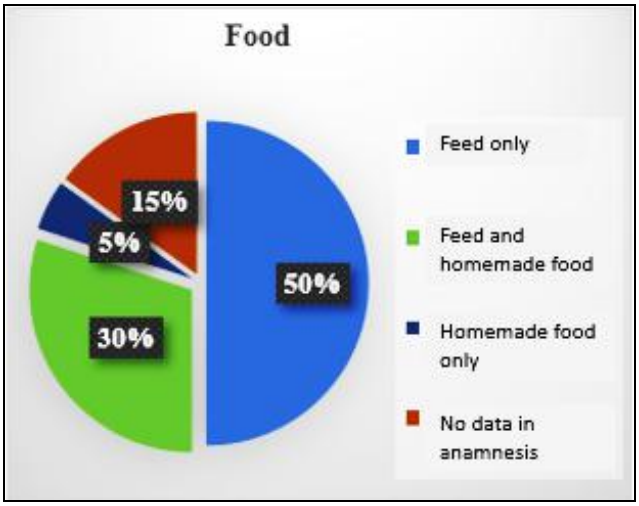
In relation to breed, Shih-tzu was the prevailing one (44%) and it has been reported as prone to urolithiasis (Rick et al., 2017). However, it seems to be super-represented here, as it is a very popular breed in the study area. Another relevant observation regarding this breed is that four uroliths were composed of struvite, carbonate, and calcium oxalate, corroborating with Houston et al. (2017), who attested that hypercalciuria usually affects this breed and is associated with stones containing calcium in their composition.

Dogs of unidentified breed represented 25% of the total, the second high percentage in this study. This reflects the distribution of dog breeds in Brazil, being a great percentage composed of dogs of unidentified breed. The other breeds represented 31% of the total: Lhasa-apso (Syme, 2012), Pug, and Rottweiler (Houston et al., 2017). Basset hound and Pinscher were also present, but no reports were found regarding the predisposition of these breeds to urolithiasis. Thus, as described by Mendóza-López et al. (2019), small-sized breeds predominate, despite medium- and large-sized breeds are present in this study. Regarding cats, all were of unidentified breed, as reported by Pimenta et al. (2013).

Regarding eating habits, 10 (50%) consumed dry food only, six (30%) dry food and homemade food, and one (5%) homemade food only; there were no data in the anamnesis of three (15%) animals (Figure 3). Among those fed with dry food only, three (15%) already consumed food specific for urinary tract treatment, being two of the three recurring cases. The homemade food reported by the tutors included: meat (mentioned six times), vegetables, rice, orange, milk, and snacks. Some animals consumed more than one type of food.

Eating habits, such as dry food consumption, little water intake, and sedentary lifestyle, living indoors only and with other contactants are factors that predispose these animals to urolithiasis (Martins et al., 2013; Costa, 2009; Rosa & Quitzan, 2011). In this study, these factors were observed for a significant percentage of animals, as 90% lived in urban areas, 60% had contactants, and 50% consumed dry food only or dry and homemade food (30%).

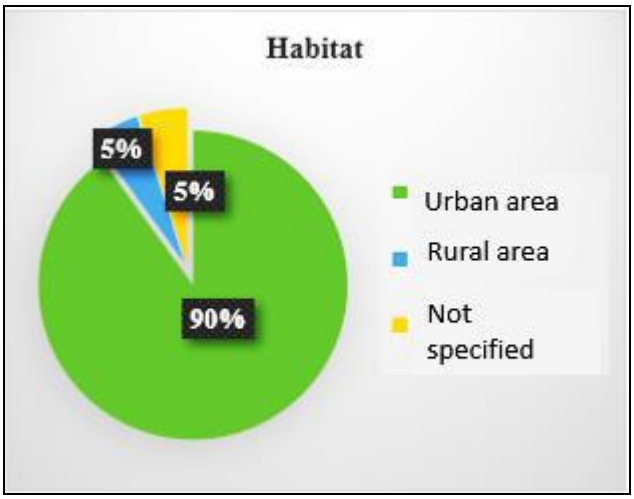
Figure 3. Eating habits.



Source: Author's archive.

As for the environment, most animals, 18 (90%), lived in houses in the urban area and one (5%) in the rural area; there was no specification for one (5%) of them (Figure 4). Regarding the contacts in these environments, seven (35%) had only one contact, three (15%) had two contacts, two (10%) had more than two contacts, two (10%) had no contact and there was no specification for six (30 %).

Figure 4. Habitat.



Source: Author's archive.

The main clinical signs reported by the tutors were: hematuria, dysuria, oliguria, iscuria, stranguria, and normuria, some of the animals showing more than one sign. Regarding water intake, it was as expected for ten animals (50%), no data were obtained for eight (40%), and two (10%) suffered from oligodipsia. Other clinical signs were anorexia, vomiting and abdominal pain.

The clinical manifestations observed in this study agree with those observed by other authors (Martins et al., 2013; Mendóza-López et al., 2019), being hematuria the most frequent clinical sign, as described by Mendóza-López, Del-Angel-Caraza, Quijano-Hernandez and Barbosa-Mirelles (2017). Clinical history, despite unspecified, can be used in urolithiasis research (Lima et al., 2017).

Among complementary laboratory analyses, the following were requested: serum creatinine for 19 cases (95%); blood count analysis for 18 cases (90%), and urinalysis and urolith analysis for seven cases (35%).

An increase in serum creatinine was observed in only two cases (10%). In 17 cases (85%), the results were within the reference values for the species. According to the International Renal Interest Society (2019), dogs are considered azotemic when blood creatinine values are above 1.4 mg/dl and cats above 1.6 mg/dl; therefore, only two urolithiasis cases (10%) were diagnosed with azotemia. However, another five (25%) yielded values between one and the upper limit for the species, condition that deserves care and monitoring.

A complete blood count analysis was requested for 18 cases (90%). Eight (44%) did not show any changes and ten analyses (56%) revealed some change, the most frequent being leukocytosis, observed in five animals, seven presenting leukocytosis and neutrophilia, and one leukocytosis and neutrophilia, plus regenerative left shift. Leukocytosis was observed isolated (three cases) or accompanied by increase in PPT (two cases), anemia (one case), thrombocytopenia (one case), and thrombocytosis plus increase in PPT (one case). Thrombocytopenia was also observed isolated in two cases. In these scenarios, leukocytosis can result from stress and pain or a secondary inflammatory response (Silva et al., 2018; Martins et al., 2013).

The most requested image exam was ultrasound, performed in 16 cases (80%), followed by pelvic radiography (one case – 5%). No information on image exam requests was found in the patient's reports of two cases (10%) and one case (5%) was sent to a veterinary clinic due to the impossibility of carrying out exams at the hospital on the day of the appointment.

Both exams can be used to confirm urolithiasis (Mendóza-López et al., 2019), and can be studied separately or combined, to improve sensitivity (Lima et al., 2017). It is worth mentioning that for radiolucent stones, it is necessary to perform double contrast using the retrograde urethrocystography technique (Crivellenti & Borin-Crivellenti, 2015).

The ultrasound images showed hyperechoic structures in the bladder lumen in 69% of the cases, forming acoustic shadows compatible with uroliths (Rick et al., 2017) and associated with thickening of the bladder wall, which is suggestive of cystitis (Martins et al., 2013). Pelvis dilation alone (6%) or together with ureteral dilatation (6%) were observed associated with the presence of obstructions in the upper urinary tract. The majority of the uroliths (90%) were identified in the urinary bladder, corroborating other studies (Lima et al., 2017; Inkelman et al., 2012).

Medical reports based on 15 image exams reveal that 93% of the uroliths were in the urinary bladder and one (7%) in the right and left kidneys and right ureter. Four animals were submitted to cystotomy to remove uroliths, but there was no information about image exams or files in the records. Thus, 18 animals (90%) had bladder urolithiasis, one (5%) kidney and ureteral urolithiasis, and one (5%) diagnosed with bladder urolithiasis was sent to another veterinarian.

Uroliths of seven dogs were sent to analysis. Four (57%) were composed of struvite, carbonate, and calcium oxalate and were extracted from four bitches. Other three (43%) were composed of struvite and were extracted from two bitches and a male dog. The percentage of each component of the uroliths is not available, because the laboratory to which they were sent does not perform quantitative analysis, and therefore it is not possible to classify them as mixed or composite uroliths.

Urinalysis was performed for seven (35%) animals, five (71.5%) dogs and two (28.5%) cats. Regarding the dogs, changes were observed in the physical aspect, such as color – amber in one urine sample (20%) and red in another (20%); turbid aspect in three samples (60%); density more than 1.040 in one sample (20%). Chemical analysis revealed the presence of protein in four samples (80%); bile pigments in one sample (20%); nitrite in two samples (40%); hidden blood in three samples (60%). Sediment analysis revealed more than seven red blood cells/field in four samples (80%); up to 10 leukocytes/field in three samples (60%), and more than 10 leukocytes/field in one sample (20%); bacteria in three samples (60%); triple phosphate crystals in two samples (40%); bilirubin crystals in one sample (20%); grainy cylinders in two samples (40%), and transition cells in one sample (20%). Other parameters have not been changed.

Urolith analysis was performed for two of the five dogs (40%) for which urinalyses were available. These two dogs

were bitches diagnosed with struvite stones. The urinalysis revealed: protein, leukocytes, hidden blood, bacteria, and triple phosphate crystals. In one of them, increase in urinary density, turbid aspect, limiting pH of 7.5, and nitrite were observed; for the other, the sediment exam also revealed transition cells and grainy cylinders.

In one of the two cats, changes in the urine physical aspect were: brown color, turbid aspect, density less than 1.020 and more than 1.040. The chemical analysis revealed abnormal pH – more than 7.0 – and the presence of protein in one sample (50%). The analysis of the sediment revealed the presence of more than seven red blood cells/field in one sample (50%), up to 10 leukocytes/field in two samples (100%), bacteria in two samples (100%), grainy cylinders in one sample (50%), triple phosphate crystals in one sample (50%). No changes were observed in other parameters. Cat uroliths were not analyzed.

Urinalysis revealed several expected changes that result from inflammatory and/or infectious processes, primary or secondary, and urine supersaturation. Urine culture was not performed for any of the urolithiasis cases of this study, despite being strongly recommended when infection of the urinary tract is suspected to have occurred (Martins et al., 2013; Lima et al., 2017).

The diagnoses were: urolithiasis in 90% of the animals (18); severe cystitis after the reoccurrence of urolithiasis (one animal – 5%), and recurring urolithiasis with severe bladder wall thickening with differential for bladder neoplasia (one animal – 5%).

Cystotomy accompanied by pharmacological therapy in the post-operative period was recommended for 65% of the cases (13), occurring one death during the post-operative period. Clinic treatment was recommended for 15% (three) of the animals. Drug intervention was recommended for 15% (three) of the animals to control pain and other clinical signs, but they died before other therapeutic options were adopted. One animal (5%) was sent to a veterinary clinic.

The post-operative therapeutic options were fluid therapy; pain killers (in decreasing order of frequency of use: metamizole, tramadol hydrochloride, meperidine, methadone, morphine, scapolamine butylbromide, and phenazopyridine hydrochloride); anti-inflammatory drugs: meloxicam and carprofen, and antibiotics: cephalothin, ampicillin, doxycycline, and metronidazole. Ranitidine hydrochloride, metoclopramide, and therapeutic diets were also prescribed, plus guidelines for changes in nutritional management.

The clinical approach consisted of fluid therapy and bladder lavage. Pharmacological therapy included antibiotics, in decreasing prescription order: metronidazole, ceftriaxone, ampicillin, and cephalexin; anti-inflammatory drugs: meloxicam and carprofen, and pain killers: metamizole, meperidine, and tramadol hydrochloride. Other medication was also used, such as gastric protectors (ranitidine hydrochloride, ondansetron, maropitant); vitamin and mineral supplements; changes in nutritional management, and therapeutic diets.

The results observed in the three cases for which the clinical approach was recommended were: improvement of the clinical signs regarding the dog diagnosed with urolithiasis reoccurrence and ureteral stricture after urethrostomy; urolith elimination and reduction of vesical sediment regarding a cat, which became incontinent after the treatment; dissolution of struvite uroliths and clinical improvement regarding a bitch.

After an animal is diagnosed with urolithiasis and its general condition is analyzed, it is necessary to establish the initial therapeutic approach, which must consider the removal of the urolith and its submission to analysis to obtain a definitive diagnosis and appropriate treatment. According to Langston, Gisselman, Palma and Mccue (2010), for uroliths located in the lower urinary tract, the clinician should first opt for non-invasive techniques to remove the stone, such as: voiding by urohydropropulsion of small uroliths, which is a clinical approach; retrograde urohydropropulsion to return the stone to the bladder, with subsequent dissolution or removal by other techniques; recovery via catheter by means of aspiration or cystoscope with a basket suitable for uroliths, and laser or extracorporeal shock wave lithotripsy for fragmentation and spontaneous elimination or removal by non-invasive techniques. It is important to note that all these methods must be applied

in association with image exams to confirm the urolith extraction (Langston et al., 2010).

The equipment necessary to perform some of the non-invasive options proposed above are still not available in most of the veterinary centers in Brazil. However, the first two examples of urohydropropulsion do not require large investments and can be applied in the veterinary routine of small animals. Thus, more-invasive options, such as cystotomy and urethrotomy, should be delayed, if the animal's clinical conditions so permit (Lulich et al., 2016; Langston et al., 2010).

When uroliths are in the upper urinary tract, as the case of a dog diagnosed with bilateral nephrolithiasis and unilateral ureterolithiasis, according to Lulich et al. (2016), intervention is recommended only if the nephrolith is causing complications. If obstruction is not happening in the dog, dissolution is an alternative, once 20% to 30% of the stones in the upper urinary tract are struvite; when obstruction occurs, minimally invasive techniques should be applied, such as endoscopic nephrolithotomy and extracorporeal shock wave lithotripsy. When located in the ureter, the best option is the placement of a ureteral stent. Regarding cats, 90% of the uroliths in the upper urinary tract are calcium oxalate, and therefore the minimally invasive endoscopic nephrolithotomy approach must be considered as first option and, in case of ureteroliths, subcutaneous ureteral bypass or ureteral stent.

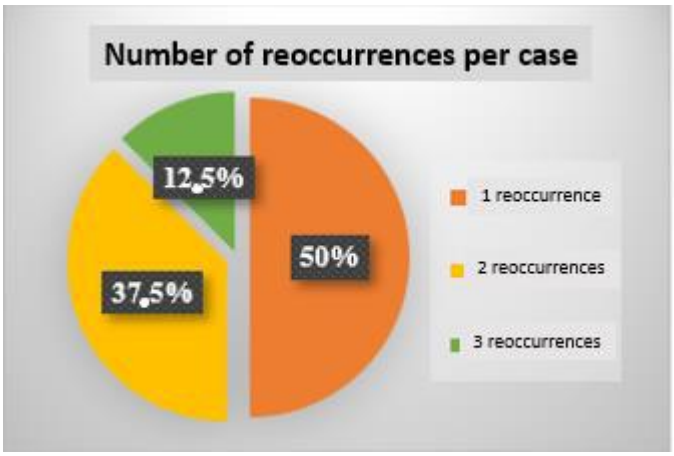
In this study the invasive approach predominated, as cystotomy was chosen for 65% (13) of the urolithiasis cases. Only 46.1% (six) of the removed uroliths were sent to analysis, because it was not approved by most of the tutors, due to the additional costs. The treatment recommended for struvite stones is dissolution, and for dogs prone to develop the disease after infections, antibiotic therapy based on urine culture and antibiogram should be instituted. A calculolytic diet should be associated with the treatment, with low magnesium and phosphorous contents, to contribute to the acidification of the urine and increase of the struvite solubility (Lulich et al., 2016; Gomes et al., 2019).

For uroliths composed of struvite, carbonate, and calcium oxalate, as not all these components can be dissolved, the choice is surgical removal (Caldeira et al., 2015). After the removal, preventive measures can represent a challenge, because the factors that lead to the precipitation of such components are conflicting, a balance point being necessary in such cases. According to Gomes et al. (2019), the ideal pH to obtain a global crystal dissolution is in the range of 6.7 and 7.0; a limiting factor is that the exact mechanisms of calcium oxalate calculi formation are still unknown. Lulich et al. (2016) proposes the administration of alkalizing salts, such as potassium citrate, combined with thiazide diuretics, such as hydrochlorothiazide, low-protein diets, and lowering urinary density as measures to minimize urolithiasis reoccurrence, being the latter the most effective to prevent reoccurrences, common to all types of uroliths, and should always be adopted.

The clinical approach used in the study cases was the adoption of a variety of drugs to complement the instituted therapy, such as antibiotics, or of supportive measures, such as appetite stimulants. Regarding antibiotics, as previously mentioned, the choice should be based on the results of the urine culture and antibiogram; however, the use of amoxicillin or sulfonamide-trimethoprim should be considered in the initial treatment (Weese et al., 2011). In this study the most prescribed antibiotic was cephalothin. Other clinical approaches that can be adopted and proved to be efficient include administration of medicinal plants and probiotics (Cruces et al., 2013; Ariza, De Queiroz, Castro, Dall'Agnol & Fioravanti, 2016).

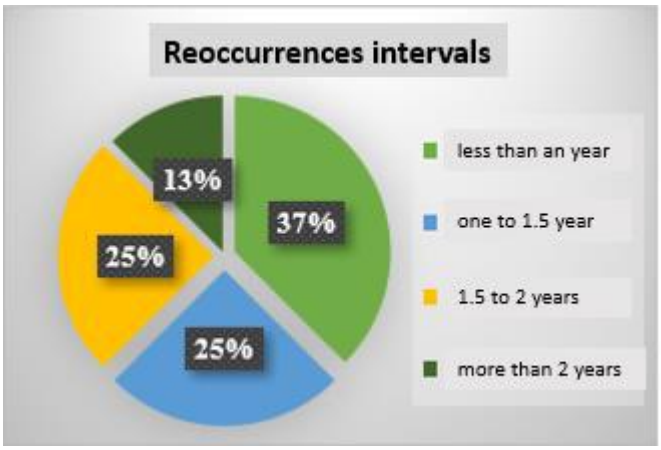
Reoccurrences were observed in 40% of the animals (eight), 50% of which (four) being the first reoccurrence; 37.5% (three) being the second, and 12.5% (one) the third reoccurrence (Figure 5). These reoccurrences happened in time intervals of less than one year (three cases – 37.5%); between one and one and a half years (two cases – 25%); between one and a half and two years (two cases – 25%); and more than two years (one case – 12.5%) (Figure 6). The remaining 60% of the cases (12) were the first urolithiasis episode (Figure 6).

Figure 5. Number of reoccurrences per case.



Source: Author's archive.

Figure 6. Intervals of reoccurrences.



Source: Author's archive.

The determination of preventive measures regarding urolithiasis reoccurrences must be based in the cause (Gomes et al., 2019). For none of the eight animals diagnosed with recurring urolithiasis, the mineral composition of the uroliths was determined in the first episodes of the disease, despite seven (87.5%) were submitted to cystotomy. According to Appel et al. (2008), 9.4% of the reoccurrences in dogs and 4% in cats are induced by sutures used for bladder wall synthesis, being Shih-tzu the breed that showed a greater predisposition to develop post-operative urolithiasis, probably being this the reason of reoccurrences in some of the animals of this study. In urinary tract surgery it is always recommended the use of absorbable monofilament sutures to reduce reoccurrence (Appel et al., 2008).

The nutritional management for the recurring cases included: dry and homemade food (two cases – 25%), therapeutic diet and meat (one case – 12.5%), urinary food (one case – 12.5%), dry food (two cases – 25%), and homemade food (one case – 12.5%). No data were available for one case (12.5%). No information on water intake or environmental management was available in the patient's records. Regarding the therapeutic approach of previous urolithiasis episodes, seven animals diagnosed with recurrent urolithiasis were submitted to cystotomy, but no analysis of the removed stone was made.

Regarding changes in nutritional management to reduce urolithiasis reoccurrence, these were restricted to changes in eating habits, with two (25%) recurring cases consuming food for the lower urinary tract treatment. Environmental management to reduce stress and sedentarism and means of stimulating the intake of water and food is highly recommended

for cats. It includes certain measures, such as: promoting a calm and spacious environment; food bowls and individual sand boxes for each animal plus an extra one, to be placed in quiet places and away from stressing situations; periodic cleaning of sand boxes and toys, among others (Costa et al., 2009; Herron & Buffington, 2010).

Regarding mortality, four dogs died – three of unknown causes, two on the day of the appointment, and one on the day after the appointment. Two of them were recurrent cases for the third time. One death occurred in the post-operative period of cystotomy associated with bladder nodulectomy, splenectomy and ovariohysterectomy.

The mortality percentage in this study was 20%, but it is overestimated by the low number of casualties (four dogs). In veterinary hospitals of the United States and Germany, this percentage varied from 0.5% to 3% in the same study period (Mendóza-López et al., 2019).

4. Conclusion

This retrospective study helped to establish a profile of animals affected by urolithiasis and hospitalized at the Veterinary Hospital of University Brazil from January 2018 to April 2019. Small dogs, especially Shih-tzu, were the most affected. It is interesting that more studies are carried out in the evaluation of urolithiasis as renal alterations in general. In these cases, the environment was a conditioning factor for the recurrence of the disease. Urolithiasis should be a differential diagnosis for an animal that fits this profile and manifests the corresponding symptoms. The mineral components of the seven uroliths sent for analysis were struvite and struvite, calcium carbonate and oxalate. These results should always guide therapeutic decisions and management changes to avoid recurrences. In turn, recurrences play an important role in disease control, and their relevance must be exposed to tutors. In addition, all the information contained in this study will significantly contribute to a better approach to this condition. However, further research should be carried out, expanding the study region, including more veterinary clinics and hospitals for greater accuracy in the correlations with urolithiasis.

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