Fat urological syndrome: incidence, nosological structure

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Abstract. This article describes the results of a study of 128 cats with urological syndrome. The study was conducted to determine the incidence of this syndrome, its nosological structure, analysis of clinical signs, as well as laboratory data characteristic of this syndrome. The data were obtained from the patients of the clinical branches of the DSTU, Rostov-on-Don, the patients had not been treated anywhere before and were first seen with urological syndrome of cats. A medical history was compiled for all cats, a clinical examination was carried out, and blood and urine were collected for analysis. As a result of the studies, it was revealed that as part of the urological syndrome, idiopathic cystitis of cats occurred in 65% of cases, urinary tract infections in 14% of cats, obstruction of the urethra caused by urethral plugs was observed in 68%, urolithiasis in 28%, and only in 0.7% of cats, proliferative changes in the urethral tract were noted. In 79% of cats with urological syndrome, it was accompanied by urethral obstruction with different mechanisms of occurrence.

1 Introduction

Traditionally, in the domestic literature, feline urological syndrome is a set of symptoms, including frequent (pollakiuria) and painful (stranguria) urination without polyuria, and hematuria (blood in the urine). The disease can also be accompanied by urination in the wrong place (periuria), which often happens when the bladder and urethra are involved in the painful process with idiopathic cystitis. Sick animals show increased excitability and excessive vocalization [1, 2, 6].

Several nosological units are accompanied by urological syndrome, including idiopathic cystitis, infection of the genitourinary tract, urolithiasis and infiltrative processes in the lower urethral tract, more often tumors. In addition, all these diseases can occur in an obstructive form, when normal urination stops with severe obstruction of urine outflow. Obstructions can be caused by both urethral plugs and urethral spasm in idiopathic cystitis, or direct urethral obstruction with stones or swelling. In foreign sources, the authors report a different prevalence of nosological units accompanied by urological syndrome, but everyone is unanimous that idiopathic cystitis is the most common cause of this syndrome, and its incidence ranges from 50% to 70% of all cats with this syndrome [2, 4, 6, 7].

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Due to insufficient data on the urological syndrome of cats and the lack of statistics on this pathology in Russia, the purpose of our study was to identify animals with urological syndrome, to determine its incidence and nosological composition.

2 Materials and research methods

The data for the analysis were obtained from patients admitted to the clinical branches of DSTU in 2018-2020. A total of 128 patients with symptoms of feline urological syndrome were recruited. All cats previously treated in veterinary clinics for feline urological syndrome were excluded from the study, as well as animals with other comorbidities such as diabetes, hypertension, hyperthyroidism, chronic kidney disease, and other systemic disorders. A history of life and illness was collected from all animals, as well as clinical signs of the disease and the degree of their manifestation. The history of the disease recorded data on the age of the animal, breed, sex, body weight, characteristics of feeding and access to water, and clinical signs of the disease. Data were obtained on the nature, duration of manifestation of clinical symptoms, frequency of urination, reproductive status, number of animals and family members, and possible stresses in the animal's habitat. All cats underwent a detailed clinical examination with an emphasis on the genitourinary and nervous systems. The bladder was probed twice, before and after urination, to determine the pain and physical characteristics of its walls and surrounding tissues, and changes in behavior during urination were noted. Neurologic examination included assessment of the knee and anal reflexes. Clinical examination was performed twice, before and after analgesia. Urine for analysis from all animals was collected by cystocentesis or during natural urination, if it occurred during the study. Some animals with idiopathic cystitis often urinate due to pain in the bladder, the bladder remains unfilled and a urine sample from such animals can only be obtained by catheterization. Physicochemical analysis of urine included the determination of the physical characteristics of urine, glucose, bilirubin, ketone bodies, hemoglobin content, pH using Uriscan 11 diagnostic strips, determination of protein concentration and the ratio of protein concentration to creatinine was performed on a BioSystems A-15 biochemical analyzer, urine density was determined using a refractometer. The urine samples were centrifuged at 1000 rpm, the sediment was examined under a microscope with a magnification of $\times 400$, with the analysis of the urine sediment.

The diagnosis of hematuria was made in the presence of 10 or more erythrocytes in the field of view, pyuria in the presence of 5 or more leukocytes in the field of view. If atypical cells and urinary tract infection were suspected, the sample was subjected to cytological examination. In addition, all samples obtained from animals with proliferative diseases of the genitourinary tract were subjected to cytological examination.

The animals underwent ultrasound and X-ray examinations of the genitourinary tract in order to identify calculi and proliferative processes.

Patients were divided into groups based on the identification of the underlying disease manifested by urological syndrome, if the patient was diagnosed with idiopathic cystitis, they were also divided into groups with the presence or absence of obstruction, as well as the type of obstruction caused by urological plugs or urethral spasm.

The results were processed statistically using the Statistica program (<http://statsoft.ru/>) using analysis of variance. The significance of differences between the means was determined using the Newman-Keuls test at $P < 0.01$.

3 Results

A total of 128 cats were examined in accordance with the protocol described above. The study population consisted of 53 (41%) short-haired, 32 (25%) long-haired domestic cats and 43 (34%) purebred cats. Pedigree cats were represented by 2 Persian, 3 Maine Coons, 1 Siamese, 9 British, 1 Burmese, 5 Russian blue cats, 17 Scottish fold cats, 3 Don Sphynxes, 2 Canadian Sphynxes. The study population consisted of 101 males (79%), and 27 females (21%), 76 males (75%) and 17 females (63%) were spayed. The majority of animal owners (70%) claimed that they went to the veterinary clinic for the first time because of problems with the urinary tract in their animals, while the remaining 30% of patients, according to their owners, had various problems with the urinary tract prior to visiting the clinic.

All owners were asked to describe in detail the symptoms for which they went to veterinary clinics, paying particular attention to the description of the animal's behavior during urination, the posture it takes, vocalization and periuria. All animals were divided into groups for similar symptoms. More than 79% of the animals suffered from dysuria and pollakiuria. Macroscopic hematuria occurred in 65% of cases (Table 1, Fig. 1, 2). Bacteria were detected in 13 cats by cytological examination of urine sediment (Fig. 4-6).

Fig. 1. Pronounced gross hematuria.

Fig. 2. Moderate gross hematuria.

Fig. 3. Microhematuria.

Hematuria with a value of > 10 erythrocytes in the field of view was observed in all studied cats with urolithiasis and in 63% of patients with other nosological units; such hematuria was not clinically manifested (Fig. 3).

Table 1. Clinical symptoms in cats with urological syndrome, heads (%).

	all cats	FIC ¹	UTI ²	UP ³	UD ⁴	neoplasia
all cats	128(100%)	83 (65%)	13 (10%)	87 (68%)	36 (28%)	1 (0.7%)
hematuria	83 (65%)	51 (61%)	9 (69%)	72 (83%)	21 (58%)	1 (100%)
stranguria	83 (65%)	69 (83%)	9 (69%)	79 (91%)	26 (72%)	1 (100%)
pollakiuria	107 (84%)	72 (87%)	10 (77%)	84 (97%)	34 (94%)	1 (100%)
periuria	89 (70%)	70 (84%)	10 (77%)	49 (56%)	19 (53%)	0
obstruction	101 (79%)	68 (82%)	7 (54%)	87 (100%)	31 (86%)	0

1 – feline idiopathic cystitis, 2 – urinary tract infection, 3 – urethral plugs, 4 – urolithiasis disease, 5 – neoplasia

Pyuria (more than 5 leukocytes in the field of view, Fig. 4-6) was observed in 92% of animals with urinary tract infections, in 41% of animals with idiopathic cystitis and urethral plugs, and in 74% of patients with urolithiasis. In the group of cats with urolithiasis, 5 patients were also diagnosed with urinary tract infection.

Fig. 4. Bacteriuria 1+.

Fig. 5. Bacteriuria 2-3+.

Fig. 6. Bacteriuria 4+.

The mean urine pH was 6.2, and rose to 6.9 in cats with bladder infections and urolithiasis. In patients with bladder infections and proliferative processes, urine was characterized by low-specific pH changes. These samples were obtained mainly from old animals. Glucosuria was observed in 16% of patients with urethral obstruction. The level of protein in urine was higher in cats with idiopathic cystitis than in animals with other nosological units, possibly due to damage to the urothelium and penetration of acute phase proteins into the urine [5, 6].

X-ray and ultrasound examinations were performed in all studied animals (Fig. 7, 8), animals with suspected urolithiasis and neoplasia were additionally performed X-ray examinations and cystoscopy. Urolithiasis was diagnosed in 36 cats, and 9 of this group were diagnosed with oxalate stones (Fig. 9), and struvite was found in 19 cats. In other animals, urinary calculi were not analyzed.

Fig. 7. Struvites in the urinary bladder of a cat, X-ray.

Fig. 8. Struvites in the cat's urinary bladder, ultrasound examination.

Fig. 9. Mixed struvite-oxalate calculi.

In the animal population studied, 16% of cats were catheterized, but urine samples were collected by cystocentesis prior to catheterization in all patients. Overall, 31% of patients with urinary tract infections and 100% of cats with neoplasia were female. Other nosological units were more widely represented in cats, and almost all patients with urethral plugs were males. The average age of animals with urological syndrome was 4.8 years. Cats with idiopathic cystitis were younger in age than animals with neoplasia. Age, body weight and sex in animals with different nosological forms of urological syndrome are presented in Table 2.

Cats with urinary tract infections and neoplasias were significantly older than those with idiopathic cystitis, urolithiasis, and urethral plugs. In cats over 10 years of age, urinary tract infections and neoplasias have been diagnosed more frequently than idiopathic cystitis.

Table 2. Age, body weight and sex in animals with urological syndrome in the studied population.

	all cats	FIC ¹	UTI ²	UP ³	UD ⁴	neoplasia
age, years	4 ± 0,8 (from 0,8 to 13)	4 ± 0,4 (from 0,8 to 9,4)	7 ± 0,5 (from 3,2 to 10)	5 ± 0,1 (from 1,4 to 11)	4 ± 0,9 (from 1,4 to 11)	13 ± 0,5 (13 years)
weight, kg	4 ± 0,9	5 ± 0,1	4 ± 0,3	5 ± 0,4	5 ± 0,3	3 ± 0,7
males, %	101 (79%)	63 (76%)	9 (69%)	86 (99%)	32 (89%)	0 (0%)
females, %	27 (21%)	20 (24%)	4 (31%)	1 (1%)	4 (11%)	1 (100%)

1 – feline idiopathic cystitis, 2 – urinary tract infection, 3 – urethral plugs, 4 – urolithiasis disease, 5 – neoplasia.

Cats with neoplasia had a lower weight than animals with idiopathic cystitis, urethral obstruction, and urinary tract infections. In the remaining groups, there were no insignificant deviations in body weight. Among the cats with urological syndrome, 91 (71%) were animals that were constantly in the apartment and did not receive a walk. On the spread of urological syndrome, after collecting anamnesis from all selected patients, the influence of the presence of other animals in the house or apartment was noted.

Feline urological syndrome was accompanied by urethral obstruction in 101 patients. Urethral obstruction was more common in animals with idiopathic cystitis (68 cats) and urolithiasis (33 cats) than in cats with urinary tract infection. The majority of patients (87) with urethral obstruction were males and only 4 females had this symptom. All cats with urethral plugs had urethral obstruction. Idiopathic cystitis was diagnosed in 83 cats (65%), urinary tract infections in 13 (10%), urethral obstruction with mucosal plugs in 87 (68%), urolithiasis in 36 (28%) cats, and only 1 cat had proliferative processes. in the genitourinary tract.

4 Discussion

According to our research, as well as the literature data we studied, idiopathic cystitis is the most common cause of feline urological syndrome. In this study, we found that idiopathic cystitis is the cause of urological syndrome in 65% of cases. The representation of idiopathic cystitis in the structural pathology of urological syndrome according to different authors in different countries ranged from 51 to 63% [2, 6, 8]. In the present study, urethral plugs were the first most common cause of feline urological syndrome, accounting for 68%. Unfortunately, obstructive uropathy is difficult to distinguish from obstruction caused by urethral plugs and urethral calculi. Feline idiopathic cystitis may be accompanied by functional obstruction due to painful urethritis, spasm of the urethral sphincter, and detrusor-sphincter dyssynergia. Urethral plugs, composed of an organic substrate and crystals (mainly struvite), mechanically block the passage of urine through the urethra, often accompanied by complete obstruction and postrenal azotemia. During various procedures, such as catheterization, urethral plugs can be pushed into the bladder and lost, leading to a misdiagnosis. Most accurately, the diagnosis of urethral plugs is confirmed by contrast radiography and urethroscopy or by direct detection during examination and flushing of the urethra. Cats with idiopathic cystitis and crystalluria are susceptible to urethral plugging, which can lead to obstruction [2, 6]. These results suggest that the prevalence of idiopathic cystitis may be higher than reported in various studies. According to the authors, the representation of urinary tract infection as a cause of urological syndrome was extremely heterogeneous. So, according to American researchers, UTIs were the cause of only 3% of urological syndrome, while in Poland and Norway the prevalence was significantly higher and amounted to 11.8%, German researchers showed even more prevalence - 18.9% [2, 6, 8]. Urinary tract infections are most common in cats with chronic kidney disease, hyperthyroidism, and diabetes mellitus [6, 7]. The above results were used by other authors to exclude patients with comorbidities from their study, which could explain the significant discrepancies in the data on the incidence of urinary tract infections in the available literature. In our study, 10% of the cats studied had a new-onset UTI, and this percentage increased to 38% when patients with urolithiasis and UTI were included in the same group.

In our study, the average age of cats with urological syndrome was 4.8 years, according to other authors, it ranged from 5.1 to 6.7 years [1, 6, 7]. Correlations were found between the age of cats and the diagnosis of UTI in this study. UTIs were diagnosed in 8% of cats over 10 years of age with symptoms of urologic syndrome, and 6% with urolithiasis and UTIs. Most reports indicate that females are more susceptible to UTI; in our study, females

with UTI made up 31% of the group of animals with UTI. Urolithiasis was observed in 28% of cats with urologic syndrome, but not all stones were chemically analyzed. Almost 19% of all patients with uroliths were also diagnosed with UTI. According to the literature, microhematuria was noted in more than 90% of animals with urological syndrome, and ranged from 80% to 91%, and crystalluria was observed in 78%, based on the results of urine sediment study, in our studies, microhematuria was observed in more than 87% animals with urological syndrome, and crystalluria was observed in 45% of all cats studied by us [2, 6]. Most of the crystal-like formations were struvite crystals. In our study, signs of hematuria in their animals with urological syndrome were noted by 65% of owners (macroscopic assessment), microscopic examination confirmed hematuria in more than 87% of the cats studied.

According to our study, pyuria was observed in 92% of cats with UTI and in 39% of patients with idiopathic cystitis. In general, pyuria was observed in 34% of animals with urological syndrome. In the literature, the incidence of pyuria in patients with urological syndrome is determined in the range from 43 to 54% [6, 8].

In our study, most of the patients with urological syndrome were castrated male European Shorthair cats. Most authors did not observe a correlation between the breed and the occurrence of urological syndrome [5, 6].

In our study, males made up 79% of the studied population, similar results were obtained by other authors, who indicated a ratio of females to males of 1:4 in cats with urological syndrome. Males are much more likely to be seen by veterinarians due to their high risk of developing obstructive uropathy, which requires urgent veterinary care.

In the present study, virtually all cats with urethral plugs were male. Symptoms of idiopathic cystitis without urethral obstruction can be fleeting and subtle, and they often disappear by the time the owner decides to consult a specialist veterinarian.

5 Output

The output supports the results of American and European studies, which showed that feline idiopathic cystitis is the most common cause of urological syndrome. The prevalence of urinary tract infections in our study was lower than according to other authors. Feline idiopathic cystitis is most commonly diagnosed in young cats, while the risk of urinary tract infections, kidney stones, and neoplasms increases with age.

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