



## Risk factors in feline lower urinary tract disease

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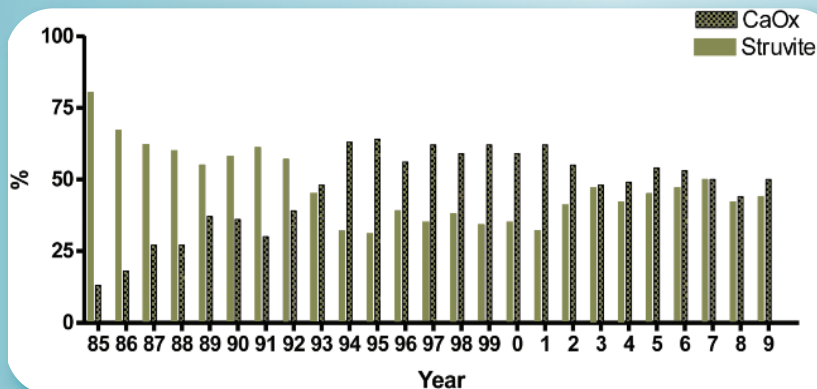
**F**eline lower urinary tract disease (FLUTD) is an inclusive term used to describe any disorder affecting the urinary bladder or urethra of cats. Signs of LUTD in cats include variable combinations of pollakiuria, stranguria, periuria, dysuria and hematuria. Lower urinary tract signs in cats can occur as a consequence of cystic calculi, bacterial urinary tract infections, neoplasia, or be idiopathic.

Lower urinary tract signs (LUTS) have been reported to occur in 1.3–1.7% of cats examined at private veterinary practices in the United States.<sup>1</sup> In one study, cats that had LUTD were significantly younger than those with other diseases and significantly older than healthy cats. No gender or breed predispositions were noted in one study;<sup>2</sup> in other studies, the Persian breed was reported to be at higher risk for LUTD, while the Siamese was a lower risk.<sup>3</sup> Indoor housed cats have been reported in several studies to be at risk for LUTD.<sup>2,4</sup> The reasons for this are unclear and are likely multifactorial; indoor housed cats may have excess body weight and decreased activity, which contribute to clinical signs.

The LUTD mentioned in these previous studies was not always specified. The two most common diagnosed feline LUTD reported in the literature are urolithiasis and feline idiopathic cystitis (obstructive or non-obstructive). Approximately 20% of cats that present with LUTS will have a urolith present; struvite and calcium oxalate (CaOx) are the two most common uroliths reported from cats (Fig 1). In 2/3 of cats that present with LUTS no definitive diagnosis can be made;<sup>5</sup> therefore, this syndrome is called feline idiopathic (or interstitial) cystitis (FIC). Bacterial urinary tract infections are not commonly reported in younger, otherwise healthy cats when evaluating data from referral institutions.<sup>5</sup>

### Risk factors for feline urolithiasis

Unfortunately, there is a lack of published studies in cats to document specific risk factors for urolithiasis. There are likely intrinsic and extrinsic factors that predispose certain cats to form stones. Specific breeds such as the Russian Blue, Himalayan and Persian have been reported to be at increased risk for various different uroliths, including struvite and CaOx.<sup>3,6</sup> Struvite stones were reported significantly more often in younger cats compared to CaOx uroliths. The Siamese, Birman, and Egyptian Mau breeds were reported to have an increased risk for urate urolithiasis (Fig 2).<sup>6,7</sup> While genetic factors may contribute to stone formation



**Fig 1** Percentage of feline calcium oxalate (CaOx) and struvite containing uroliths submitted to the Stonelab from 1985–2009. While the ratio of CaOx containing stones to struvite containing stones significantly increased over the years, these two stones are now submitted in approximately equal proportions to our laboratory.

in certain breeds, the cat's environment may also contribute to the disease. Stress related events and obesity have not been evaluated in cats with stone disease, but some hypothesise these factors may contribute to stone formation in some cats.

Indoor housed cats are at risk for LUTS (and possibly urolithiasis) as are neutered males and spayed females. While we are uncertain why this association is present, obesity is usually more common in these cats due to a more sedentary lifestyle. Obesity has been reported in as much as 25% of cats and 29% were considered overweight when their owners were asked.<sup>8</sup> While studies linking obesity and urolithiasis in cats have not been reported, there are reports finding associations of these two diseases in humans<sup>9</sup> where the prevalence of CaOx and uric acid stones has been reported to increase with increasing body size.<sup>10</sup> In fact, the association between increased body weight, body mass index, waist circumference and kidney stones has been well documented in humans.<sup>9</sup> Finally, there are papers suggesting that stressful life events can result in more clinical events of urinary stone disease in humans.<sup>11</sup> Studies investigating body mass index, body weight, and environmental stressors and urinary stone disease are warranted in feline patients to see what relationships exist.

### Risk factors for FIC

In a recent paper evaluating obstructive FIC, the mean age of cats with urethral obstruction was significantly lower compared to controls, while the mean body weight was higher (Fig 3). The proportion of indoor–outdoor cats was significantly lower in the study group compared to the control group, and the proportion of cats consuming only dry food was higher.<sup>12</sup> Therefore, like urolithiasis, indoor housing has been reported to be a risk factor as well as excessive body weight and decreased activity.

While stressful events have not been investigated as a risk factor for urinary stone disease in cats, papers have been published investigating why stress may increase clinical signs in cats predisposed to FIC. Alterations in the neuroendocrine systems have been reported (Fig 4)<sup>13,14</sup> and studies suggest there



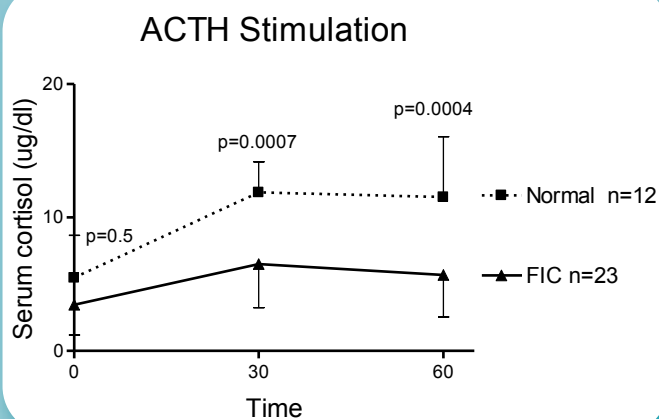
**Fig 2** Photograph of urate calculi submitted to our laboratory which was removed from the bladder of a Siamese cat. Other breeds such as the Egyptian Mau and Birman have also been reported at risk for this type of urolith.

is an uncoupling of these two systems that can lead to the clinical signs of FIC. While we have noted abnormalities in the sympathetic and endocrine systems, we have also found a decreased functional sensitivity of the alpha-2 adrenoceptors in cats with FIC.<sup>15</sup> In addition to sensory and efferent neural abnormalities, the stress response system can be altered by a variety of cytokines binding to cell surface receptors and may even be associated with stressors that occur in utero. Research on other species (eg, mice) suggests that events experienced during development may affect visceral sensory systems and result in chronic idiopathic disorders.<sup>16</sup>

A recent study of healthy cats and cats with FIC found that environmental stressors, also resulted in increased number of sickness behaviors (eg, vomiting, lethargy, anorexia) in cats with FIC when the results were controlled for other factors.<sup>17</sup> Cats with FIC have a variable combination of comorbid disorders such as



**Fig 3** Lateral radiograph projection of a 5-year-old male castrated domestic shorthair that presented with a urethral obstruction. The cat's bladder was large and turgid; his body condition score was 8/9. He was diagnosed with obstructive feline idiopathic cystitis.



**Fig 4** The mean serum cortisol response  $\pm$  SD to 125  $\mu$ g of synthetic adrenocorticotrophic hormone (ACTH) administered intramuscularly was significantly less in cats with FIC than in healthy cats. Other studies have confirmed a 'heightened' sympathetic nervous system in cats with FIC suggesting these two stress response systems are altered in cats with this disease.

behavioral, endocrine, cardiovascular and gastrointestinal problems,<sup>2,4,18</sup> and it is imperative that a complete history, including signs not related to the LUT, be evaluated in these cats. Detailed environmental histories are also important. This may alter the therapeutic approach for management of the disease.

### Treatment protocols for urolithiasis and FIC

While these two diseases are not the same and the therapeutic approach for the acute presentation is quite different, the long term management of these two diseases actually has a very similar foundation. In each case, it is important to obtain a thorough environmental history and for the clinician to gain an understanding of the owners attachment to the cat and their willingness to adhere to the suggestions provided. A body condition score and accurate weight should be obtained at the initial visit. For cats with urolithiasis, once the stone has been removed, a dietary change may be indicated. For cats with FIC, after treating the initial bout of clinical signs with analgesics (eg, buprenorphine), a diet increased in moisture is often recommended. The specific diet chosen for either disease needs to account for other comorbid conditions that may be present such as obesity, renal disease, cardiovascular disease, dermatologic, or gastrointestinal disease.

For both cats with urolithiasis and those with FIC, a diet high in moisture may be best, assuming the owner is willing to feed it and the cat is willing to eat it. A high moisture diet is recommended for cats with stones to decrease the urine concentration of mineral precursors and is the cornerstone of therapy for urolithiasis in human<sup>19</sup> and veterinary medicine. Increasing the water content for cats with FIC may help improve clinical signs by encouraging frequent voidings. It has been reported that LUTS recurred in only 11% of affected FIC cats during 1 year of feeding the canned formulation of a dietary product. Recurrence occurred in 39% of cats fed the dry formulation of the same food, suggesting that increased moisture may be important, but the reasons for this effect remain to be determined.<sup>20</sup> One hypothesis is that increasing water intake will decrease the urine specific gravity and potentially decrease the concentration of noxious substances within the urine and alleviate pain associated with FIC.

Increasing water content in the diet can be achieved most easily by feeding a canned diet; the canned food should be placed

in a separate container next to the cat's regular diet. If the canned food is not consumed, water can be added to the dry kibble to achieve higher moisture content, although 85% moisture is difficult to attain using this method. Gradual introduction of the high moisture diet may avoid a short initial period of diarrhea. If the cat does not accept and tolerate a canned diet, attempts can be made to increase voluntary water intake by using drinking fountains, and by adding flavored juices (ham, tuna) or ice cubes to the pet's drinking water. Urine specific gravity should be monitored at periodic re-evaluation until the adequacy of the current strategy is assessed. Urine specific gravity should be evaluated from samples obtained at home to gain a better understanding of owner compliance and water intake in the home environment. This will also prevent multiple, potentially stressful visits to the veterinarian.

The specific diet chosen will depend on what other conditions the cat may have. For example, if the pet is obese, a canned weight loss diet could be used. Diet details depend on the individual. For those cats that are overweight and have urolithiasis, canned foods designed for weight loss may be indicated. The diets should also be evaluated for the minerals of interest (eg, calcium, oxalate, magnesium, phosphorus) depending on what type of stone was removed from the cat. For those with FIC and obesity (Fig 5), canned prescription weight loss diets are usually appropriate unless the cat is prone to obstruction. For obstructive FIC, a weight loss diet that produces a non-alkaline pH may be helpful.

If obesity needs to be addressed, we aim for 1% loss of body weight per week, but any weight loss that is achieved should be encouraged. We do not recommend more than 2% loss of body weight so we can minimize lean body mass loss and the tendency for obnoxious food seeking behaviors that can develop at this level. In multi-cat households or in cats that are free fed, the owner should be instructed on how to change to multiple meal feedings, separate the cats, or consider alternative 'fat-cat houses' for feeding the various cats in the household separately. Owners should consider using a gram scale, which is helpful for both canned and dry food. This encourages accurate measurements as well as compliance.

There are many diet options available for weight loss in cats. Therapeutic diets formulated for active loss can be beneficial as

these are higher in protein and other essential nutrients relative to calories. The mineral profiles should be evaluated in those cats with stone disease; consultation with a veterinary nutritionist is recommended. The diets marketed as 'high protein/low carbohydrates' can also contain a large amount of fat, so the amount fed is typically very low and might not be acceptable to the owner (or the cat). Using maintenance or other 'over-the-counter' diets risk potential dietary deficiencies; as the calories are restricted so are the nutrients. This is especially important for cats that are morbidly obese (>30–40% over the desired weight) with body condition scores of 8–9/9. A 1% per week weight loss can take almost a year to achieve the desired body condition and, therefore, the correct diet is critical. For extremely obese cats one should also use caution when prescribing very high fiber diets as a sudden switch could predispose them to constipation. For dietary recommendations in cats with multiple problems like obesity and FIC or urolithiasis, consultations with a specialist in veterinary nutrition are advised.

It is important when managing chronic diseases in cats like urolithiasis, FIC, obesity, or a combination of these that a treatment program, including dietary changes, environmental adjustments, and monthly check-ups (either by phone or in the hospital) are done to ensure success.<sup>21</sup> Often these monitoring



**Fig 5** An overweight cat that presented for inappropriate urinations as well as alopecia and pustules on the ventral abdomen and inguinal area. This cat was diagnosed with feline idiopathic cystitis; the skin condition was thought to be self excoriations possibly secondary to referred pain. The cat was managed with analgesic therapy and multimodal environmental enrichment therapy. A weight loss program was also discussed.



**Fig 6** A photograph of a middle aged overweight cat for its medical record. A dorsal view of a cat such as this can be taken to help owners visually track the process of the weight loss program that is implemented.

programs can be maintained with the help of a dedicated nurse in the practice. Once an environmental and dietary history has been evaluated, a tailored plan to decrease stress levels and optimize the indoor environment for the cat should be designed. I rarely change more than one thing in the house at a time (including diet) so the cat and the owner are not overwhelmed. Issues such as food and water, dietary needs, litter boxes, social contact and conflicts, space and activity should be addressed. The client should be contacted 3–5 days after beginning the program and small adjustments made at that time. Continued follow-up consultations can be made to evaluate the cat's weight, body condition, and other changes in behavior. The time frame for these rechecks will depend on the client's needs, and what progress has or has not been made. Specific goals should be outlined and positive reinforcement for the owner when goals are met is helpful. If obesity is being simultaneously managed, photographs can easily be taken and logged into the record for comparisons to be made (Fig 6).

### Conclusions

Lower urinary tract disorders in cats can be frustrating to manage. There are various risk factors and stress and obesity may play a role in both urolithiasis and FIC. A tailored, well designed multimodal environmental modification protocol<sup>18</sup> can help the owner to reach the desired goals for their cat. Addressing multiple issues is often warranted for a successful outcome.

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