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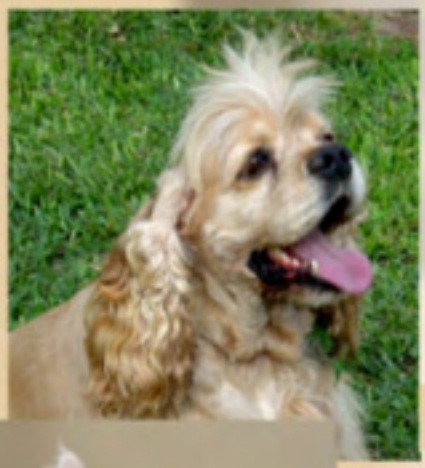

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RESUMEN

animales de compañía

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Graduado en la Universidad de Melbourne, pasó un año como interno clínico en la misma institución después de su graduación. Trabajó en la práctica veterinaria de bovinos de carne y leche en Alberta, Canadá. Concluyó su residencia de Medicina Interna en Animales de Compañía en la Universidad de Pennsylvania. Después de varios años como profesor en la Universidad de Florida, donde se especializó y estudió enfermedades de las vías urinarias, en 1992 llegó a ser profesor y Jefe del Departamento de Ciencias Clínicas Veterinarias en la Universidad del Estado de Louisiana, Facultad de Medicina Veterinaria. El Dr. Senior es Diplomado del Colegio Americano de Medicina Interna Veterinaria (ACVIM) y del Colegio Europeo de Medicina Interna Veterinaria (Animales de Compañía). Es coordinador de la Conferencia Norteamericana de Veterinaria. Participó en el rescate de animales después del huracán Katrina.

FELINE LOWER URINARY TRACT DISEASE

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Feline lower urinary tract disease (FLUTD) is one of the most common reasons for cats to be presented for veterinary care. The most dramatic condition of the lower urinary tract of cats is urethral obstruction with subsequent life-threatening postrenal azotemia. This condition occurs almost always in male cats, very rarely in females. In addition, many cats develop signs of lower urinary tract inflammation without urethral obstruction. The nonobstruc-tive form affects males and females with equal frequency and neutered animals are most at risk.

ETIOLOGY:

Most cases of urethral obstruction are caused by occlusion of the urethra with a mixture of proteinaceous material and mineral precipitates: either many individual crystals or fully formed uroliths. However, on rare occasions obstruction can be caused by proteinaceous material alone without crystals. Small uroliths can also induce urethral obstruction in cats. Most crystals and uroliths in the obstructive material are composed of struvite but other mineral types also may be involved.

Table 1. Causes of non-obstructive FLUTD (% of total)

	OSU* (1993-1995)	**U. Minn (1989)**
	n =109	n =111
Idiopathic cystitis	64	69
Urolithiasis	15	21
Anatomic defect	11	-
Behavioral problem	9	-
Neoplasia	<2	-
Urinary tract infection	<1	2

* The Ohio State University.

Behavioral disturbances with urination in inappropriate locations (spraying) must always be separated from FLUTD. Known causes of nonobstructive FLUTD include urolithiasis, UTI, and tumors. Urolithiasis is more common than UTI which is present in less than 10% of cases (**Table 1**). However, cats with permanent perineal urethrostomy and cats older than 12 years are more prone to bacterial UTI. Neoplasia of the bladder is rare and is confined to cats older than seven years. Most bladder neoplasms in cats are malignant (80%). Other rare causes of FLUTD include fungal infections, parasitic infestations, anatomic defects such as urethral stricture, neurogenic disorders, and foreign bodies. After all known causes are ruled out there remains a large subset of patients for which the cause of FLUTD remains unknown. Various causes of idiopathic FLUTD have been postulated including virus infection, food allergy, immune-mediated processes, deficiency of protective mucosal glycosaminoglycan, and stress.

PATHOPHYSIOLOGY:

Urethral obstruction: The source of protein-aceous mucoid material in urethral plugs is thought to be urethral mucus-secreting glands, but the role of excessive or abnormal mucus production in obstructive FLUTD has yet to be clarified. Crystals formed in urine that become incorporated into the mucus add bulk to the mass of material and probably contribute to the likelihood of urethral obstruction. In most cases the crystals are composed of struvite which seems at odds with the predominance of calcium oxalate uroliths in cats. The reason for this discrepancy is not known.

Prolonged urethral obstruction causes postrenal azotemia, dehydration, hyperkalemia, and metabolic acidosis. Within two days of complete obstruction, the cardiotoxic effects of hyperkalemia become life-threatening. Typical ECG findings include bradycardia, absence of a P wave, wide sine-wave QRS complexes, and a ‘tented’ T wave. If left untreated, cardiac arrest ensues.

Nonobstructive inflammation: While inflammation of the bladder caused by urolithiasis, lower UTI, and bladder tumors is readily understood, in the large proportion of patients presented with idiopathic FLUTD, the pathophysiologic mechanisms remain obscure. Similarities have been noticed between interstitial cystitis of humans, another idiopathic condition, and idiopathic cystitis of cats. Within this context, several mechanisms of pain perception and development of inflammation in the bladder that could be intrinsic to both human interstitial cystitis and idiopathic FLUTD have been elucidated. Bladder wall permeability appears to be increased; affected patients excrete less glycosaminoglycan (a substance that provides a protective barrier for the uroepithelium) in 24-hour urine samples; and substance P (a primary mediator of inflammation that can enhance vascular permeability and induce mast cell degranulation) may be released in excessive amounts from C fibers in the bladder wall. Although such investigations have provided insights for possible new treatments and might explain why some previously used empirical treatments have been effective, at this point little progress has been made to reduce the number of patients designated as having idiopathic FLUTD.

CLINICAL PRESENTATION:

Obstructive: Urethral obstruction usually occurs in male cats with a peak occurrence between 2–5 years of age. Obstructed cats strain unproductively to urinate and may cry out during the attempt. Licking of the genital region is frequently observed. Patients often hide in a secluded area. After 24–36 hours of obstruction, cats become very depressed and after 48 hours they progress toward coma and die. Patients examined soon after obstruction may be fractious and resist examination violently. After more prolonged obstruction, patients become progressively more depressed. An enlarged firm bladder is felt on abdominal palpation. The external genitalia are hyperemic and manipulation of the penis and prepuce may cause intense pain. Mucocrystalline material may be observed protruding from, or be easily expressed from, the penile urethra.

Nonobstructive: Signs of nonobstructive FLUTD are variable but usually include stranguria, pollakiuria, hematuria, and dysuria. Affected cats vocalize during urination and urinate in inappropriate places. Clinical signs tend to wax and wane spontaneously in severity with periods of normalcy between episodes. The bladder of cats with nonobstructed FLUTD is usually small with a thickened wall. Bladder palpation can cause discomfort. The penis and preputial area may appear hyperemic.

DIAGNOSIS:

Obstructive: Obstructive FLUTD is identified by palpation of an enlarged firm bladder. Urinalysis and urine culture can be performed on urine collected by cystocente-sis before urethral catheterization or via the catheter after relief of the obstruction. Serum creatinine and BUN (urea) values allow assessment of the degree of azotemia. Serum potassium levels and an ECG tracing should be performed in depressed cats to assess cardiotoxicity associated with hyperkalemia.

Nonobstructive: Nonobstructive FLUTD should be assessed by urinalysis and with a urine culture and sensitivity test in those rare instances where bacterial infection is suspected. In the urine sediment, hematuria is noted in a large proportion of cats but pyuria is rare. Absence of hematuria does not rule out FLUTD because cystoscopically visible lesions can exist in the presence of a normal urine sediment. The mineral type of crystals in the urine sediment should be noted. Plain radiographs of the abdomen can reveal radiopaque uroliths (e.g. calcium oxalate) in the bladder, but double contrast cysto-graphy or ultrasound are sometimes necessary to detect more radiolucent uroliths and foreign bodies. Cystos-copy can reveal submucosal edema and punctate hemorrhages, called glomerulations, often associated with idiopathic FLUTD.

MANAGEMENT:

Obstructive: Affected cats must be handled very gently. Rehydration with intravenous fluids, preferably 2% dextrose in 0.45% saline, should be achieved in four hours. Severe hyperkalemia should be treated with sodium bicarbonate, insu-lin/dextrose, or calcium gluconate (**Table 2**). Metabolic acidosis can be corrected with sodium bicarbonate.

Table 2. Management of hyperkalemia in urethral obstruction
Bicarbonate
Amount of HCO_3 required (mM) = 0.3 x body weight (kg) x base deficit OR 1–2 mmol/kg i/v
Insulin/dextrose*
Dextrose 50%: 1.5 g/kg i/v

Insulin: 1 U/3 g dextrose
Calcium gluconate**
Calcium gluconate 10%: 0.5–1 ml/kg i/v

Urethral obstruction can be relieved once cardiac stability is achieved. Deep tranquilization and analgesia or general anesthesia is required to reduce movement during the urethral catheterization process so that urethral trauma is minimized. The penis should be retracted caudoventrally. Saline is back flushed through an open-ended catheter as it is slowly advanced into the urethra. If urethral catheteriza-tion is impossible, the bladder can be decompressed by removing 20–30 ml of urine by cystocentesis. A prepubic cystostomy catheter can be placed temporarily to allow metabolic stabilization prior to additional attempts to resolve the obstruction. On occasion, emergency perineal urethrostomy may be required; however, this is only recommended as a salvage procedure because it predisposes to subsequent recurrent UTI. Urethral muscle spasm can occlude the urethra even after the obstructing material is removed, particularly if the urethra has been excessively traumatized. An indwelling urethral catheter can be placed for 24–48 hours. Medications to control urethral spasm include phenoxybenza-mine (5 mg p/o q24h for 3–5 days), diazepam (2.5 mg p/o q12h for 3–5 days), and prednisone (2.5 mg p/o q12h for 3–5 days). Broad-spectrum antimicrobial drugs should be administered, particularly when an indwelling catheter is used. The antimicrobial may need to be changed after the indwelling urethral catheter is removed because the urinary tract tends to become colonized with resistant bacteria.

Postobstructive diuresis may last up to three days and pre-disposes cats to dehydration and hypokalemia. Intravenous fluids should be given to maintain hydration and normo-kalemia. Intravenous potassium administration should not exceed 0.5 mEq (mmol)/kg/hour. Once the patient is able to eat and drink, the rate of intravenous fluid administration should be reduced gradually over 12–24 hours with body weight monitored closely to see if the cat becomes dehydrated. If normal hydration is maintained, intravenous fluid adminis-tration can be withdrawn.

Although crystals and uroliths associated with urethral obstruction in cats are almost always composed of struvite, they should be analyzed so that appropriate dietary and treatment strategies can be adopted to prevent recurrence.

Nonobstructive: Urolithiasis and UTI can be managed according to the principles outlined in the sections above. Calcium oxalate uroliths must be removed surgically, struvite uroliths can be dissolved, and culture and sensitivity tests should be performed on those cats with UTI to allow an appropriate choice of antimicrobial. Little is known regarding treatment of neoplasia of the lower urinary tract of cats. Surgical resection and follow-up chemotherapy of malignant tumors appear logical.

A wide variety of empirical remedies have been claimed to be successful in the treatment of idiopathic FLUTD. The waxing-waning nature of the clinical signs makes evaluation of treatment modalities difficult unless clinical trials are properly controlled. However, very few controlled trials have been performed. Canned diets appear to be preventive. Diets that reduce the activity product of solutes in urine to a point where mineral precipitation is unlikely are recommended so that any possible contribution of crystalluria to inflammation is eliminated. However, the relationship between simple crystalluria (not urolithiasis) and idiopathic FLUTD has not been established. Many empirical and symptomatic treatments have been given to control clinical signs (**Table 3**).

Table 3. Empirical treatments to manage idiopathic FLUTD

Strategy	Rationale
Diet (low struvite activity)	Crystalluria
Antimicrobials	Bacterial infection
Corticosteroids	Immune-mediated inflammation
Diuretics	Urine toxins
Anticholinergics	Detrusor hyperactivity
Glycosaminoglycans	Deficient mucus barrier
Elimination diet	Food allergy

This list of ‘remedies’ reflects the frustration of clinicians attempting to manage idiopathic FLUTD with minimal knowledge of the underlying etiology and pathogenesis, and therefore limited logic in the approach

to treatment. Unfortunately, the manage-ment of interstitial cystitis in women, another condition of uncertain etiology, is similar.

'Stress' has always figured prominently among the folklore of idiopathic FLUTD and it is difficult to separate stress-related behavioral disturbances that cats might exhibit because of their territorial spraying behavior from organic disease of the urinary bladder that might also be induced by stress. It is always advisable to question owners carefully regarding new 'threaten-ing' stressors that may have been added to the cat's environment, e.g. new pets, the arrival of new children, relocation.

Feeding canned food and avoiding feeding dry food appears to be effective in reducing the recurrence of idiopathic FLUTD by an as yet unknown mechanism. The tricyclic anti-depressant, amitriptyline (5–10 mg p/o q12h) yielded encouraging long-term suppression of clinical signs in an uncontrolled clinical study of cats with highly recurrent idiopathic FLUTD. Speculation on the cause of abatement of clinical signs included suppression of pain perception (analgesia) and local inhibition of mediators of inflammation in the bladder wall. Urohydrodistension of the bladder to 80 cm H_2O pressure has provided extended symptomatic relief for women with interstitial cystitis. A similar procedure has been suggested for cats with idiopathic FLUTD but controlled studies are lacking.

Among the treatments thought to be less effective are intravescicular DMSO, oral glycosaminoglycan replacement treat-ment, hypoallergenic diets, anticholinergic agents, antibiotics, and corticosteroids. A solution of DMSO 50% instilled into the bladder for 10–15 minutes during general anesthesia twice weekly for 2–3 weeks has been advocated for the treatment of idiopathic FLUTD on the basis that it is cleared for use in interstitial cystitis in women. No controlled studies support the effectiveness of DMSO in cats. Glyco-saminoglycans are cleared for compassionate use in women with interstitial cystitis with the rationale that they are excreted in the urine and act as a replacement for a defective endogenous glycosaminoglycan layer. Their use is contro-versial but there have been suggestions that pentosan polysulfate (10 mg/kg p/o q12h) might alleviate clinical signs in cats with idiopathic FLUTD. Hypoallergenic diets to avoid an, as yet, unknown allergen that induces bladder inflamma-tion have been recommended without critical evaluation. Anticholinergic drugs such as propantheline (7.5 mg p/o q12h) have been suggested for symptomatic control of pollakiuria in cats with idiopathic FLUTD but the efficacy of such treatment is unknown. Antibiotics have been given empirically for years to control UTI in cats with idiopathic FLUTD, even though urine culture failed to grow microorganisms. Corticosteroids have been given to control inflammation. The effect of antibiotics and corticosteroids on the course and clinical signs of idiopathic FLUTD has not been subjected to controlled studies.