

Advances in Understanding and Treatment of Feline Inappropriate Elimination

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Feline inappropriate elimination is the number one behavioral reason for relinquishment of cats to shelters and has historically been the most commonly reported feline problem addressed by behavior professionals. Veterinarians are hence challenged to uncover the underlying motivation for this behavior so that an accurate diagnosis can be made and an effective treatment plan implemented. Before a behavioral diagnosis can be made, underlying medical disease must be addressed, making a comprehensive physical evaluation imperative. After all medical issues have been addressed, a behavior diagnoses list is made based on detailed historical information obtained from the cat owner. A distinction is first established between marking and inappropriate toileting, according to elimination postures described by the owner and the social relevance of the sites of inappropriate eliminations. Next, inadequacies of the litter box management are identified and subsequent aversions and preferences, including litter box aversion, substrate aversion, location aversion, substrate preference, and location preference, can be diagnosed. The practitioner should be cognizant of the fact that anxiety from the environment and social conflict may play a major role in both marking and inappropriate toileting behaviors. Once both the medical and behavioral diagnoses are established, a treatment plan catered to the individual cat, owner, and household environment can be formulated. This should include acceptable forms of marking when indicated, appropriate litter box management and hygiene, reduction of environmental stressors, including resolution of social conflict in multicat households, proper treatment and restricted access to soiled areas, pheromone application, and, when indicated, anxiolytic drug therapy.

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Feline inappropriate elimination is defined as urination and/or defecation outside of an owner-designated elimination location. Although the cat may not recognize its own elimination patterns as problematic, owners of such cats find it quite undesirable, making it the number one behavioral reason for relinquishment of cats to shelters¹ and a common reason for the return of a previously adopted cat to a shelter.² Furthermore, elimination problems have historically been the most commonly reported feline problem addressed by behavior professionals.³⁻⁵ Recent reports, however, show that this frequency may be on the decline.^{5,6} This decline in presentation to behavioral specialists suggests that the general companion animal practitioner is better equipped to diagnose and treat such problems. This article aims to boost general practitioners' knowledge regarding the current diagnosis and treatment strategies available for cats with elimination problems.

Making a Diagnosis

Before a definitive behavioral etiology for elimination problems can be made, underlying medical disease must be ruled out and addressed. Although the medical evaluation should encompass all physical aspects, special attention should be paid to factors causing discomfort to the lower urinary tract (i.e., urinary tract infection, urolithiasis, neoplasia, cystitis) or gastrointestinal system (any cause of diarrhea, constipation, or pelvic pain), and to organ system or endocrine disease that might increase elimination volume and, therefore, urgency (i.e., hyperthyroidism, diabetes mellitus, chronic kidney disease). A thorough physical examination and a minimum diagnostic database, including a complete blood count, serum chemistry profile, total T4, fecal analysis, and urinalysis should rule out most of these factors. Further diagnostic testing, such as urine culture, abdominal/pelvic radiographs, and abdominal ultrasound, should be performed based on the results of the minimum database. If a medical etiology is not determined, then a behavioral diagnosis can be pursued. Practitioners should be cognizant that medical and behavioral pathologies often coexist and both aspects should be addressed to have a successful treatment outcome. Cats suffering from medical disease also benefit from behavioral management.^{7,8}

The behavioral diagnosis is made based on a complete behavioral history. Characterization of the elimination hab-

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its, such as frequency and duration of the problem, elimination posture, volume eliminated, location of soiling, and substrates or objects on which the cat eliminates, is pertinent for a behavioral diagnosis. Information regarding the litter box characteristics and management, as well as litter type, should also be obtained. Furthermore, environmental and household details, including adults, children, and other animals living in or frequenting the home, any recent home renovations or changes in the daily routine, and presence of outdoor cats, is equally important information because it provides a means of identifying underlying stressors that may be contributing to the elimination behavior. An efficient means of collecting elimination, litter box, and environmental information is having owners complete a behavioral history questionnaire, as presented in Table 1, before the appointment.

Gathering this information allows one to discern the motivation behind the elimination pattern and, therefore assign a behavioral diagnosis. Understanding the motivational diagnosis then dictates the path of treatment. The first step in making a behavioral diagnosis is to discriminate between marking, a form of communication, and inappropriate toileting, a means of voiding bladder and/or bowel contents. Keep in mind some cats will present with concurrent marking

and inappropriate toileting diagnoses.⁹ See Figure 1 for a flowchart for diagnosing feline inappropriate elimination disorders.

Marking

When urine marking, the cat assumes a standing posture with the tail raised and sprays urine back against an object. Often the tail quivers as a small amount of urine is sprayed and no digging or covering behaviors are shown.^{10,11} Objects marked are typically items of social significance, such as windows or doors where outdoor cats are detectable, areas of the home where interactions of conflict have occurred, or items containing the scent of a particular person or animal in the household.¹² Marking from a squatting posture is less common, but should be diagnosed if urine or feces are found deposited primarily in socially relevant locations. Marking with feces, middening, is less common and its diagnosis is based on the social importance of the location¹³ and a lack of digging and covering behavior. Urine marking in intact cats is a normal signal of reproductive status,¹⁴ yet 10% of neutered males and 5% of spayed females persist in showing urine-marking behaviors.¹⁵ Motivations for neutered cats to urine

Table 1. Feline Behavioral History Questionnaire

Elimination Habits

- 1) Does your cat's urine or stools ever appear abnormal, either inside or outside of the box?
- 2) Does your cat have any history of urinary or gastrointestinal tract problems, including a urinary tract infection or obstruction, constipation, or diarrhea?
- 3) Does your cat urinate outside the box? If so, please list all locations.
- 4) If your cat urinates outside the box, have you ever witnessed it? If so, please describe your cat's posture (i.e., squatting vs. standing, tail down and to the side vs. erect).
- 5) Does your cat have bowel movements outside of the litter box? If so, please list all locations.
- 6) Are there certain objects or materials outside of the box on which your cat will eliminate? If so, what?
- 7) Does your cat cover up his eliminations in the litter box?
- 8) Does your cat ever show scratching or digging behaviors before eliminating outside the box?
- 9) What products do you use to clean areas where your cat has soiled?

Litter Box Details

- 1) How many litter boxes do you have?
- 2) Where are the litter boxes located?
- 3) What type of litter do you use? Is this a clumping litter?
- 4) Do some or all of your litter boxes have covers?
- 5) Do some or all of your litter boxes have liners?
- 6) How deep is the litter in the box?
- 7) How often do you scoop the urine or stools from the box?
- 8) How often do you empty the entire contents of the box and clean it?

Environmental

- 10) Please list all the people living in your household.
- 11) Please list all the animals in the household in the order in which they were obtained.
- 12) If you have a multiple cat household, do you ever notice staring, growling, hissing, chasing, or fighting between any of your cats?
- 13) How does your pet react to strangers?
- 14) How does your cat react to loud noises?
- 15) Has your household changed since acquiring this pet? If so, when and how?
- 16) Was anything unusual going on in your cat's environment before the onset of the elimination problem?
- 17) Does your cat have access to the outdoors?
- 18) If you cat is strictly indoors, does he have visual access to outdoor cats? If so, what is his reaction?

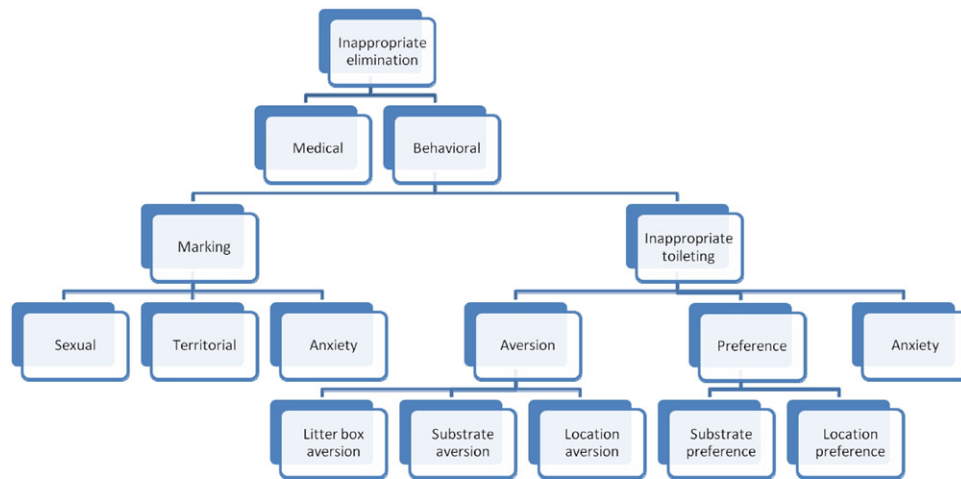


Figure 1. Flowchart for diagnosing feline behavioral inappropriate elimination disorders.

mark include territorial signaling and anxiety associated with social conflict or environmental stressors.^{16,17} Multicat households are often the source of anxiety-induced urine marking and, in fact, the incidence of marking increases as the number of cats in a home increases.¹⁸ Anxiety as a result of household or family changes, poor litter box management, the inability to escape the presence of outdoor cats, or the absence of the owner is also a major cause of urine-marking behavior.^{13,16}

Inappropriate Toileting

Unlike marking, toileting behaviors serve the purpose of voiding bladder and bowel and are associated with a squatting posture.¹⁰ Toileting cats will typically display digging behaviors before and covering behaviors after eliminating¹⁹ and will typically deposit a large volume, as would be associated with a fully voided bladder or bowel, onto a horizontal surface.¹² Toileting behaviors that occur outside of the litter box are often related to litter box management²⁰ as cats develop aversions to the available litter box options and preferences for those outside of the owner-designated elimination area(s).¹² Determining the specific aversions and preferences will aid in the diagnosis and treatment of inappropriate toileting behaviors.

Litter Box and Substrate Aversions

Aversion to the litter box can develop as a result of poor cleaning hygiene or from other unpleasant characteristics of the box. For example, covered litter boxes may trap odors and prevent the cat from having a safe vantage point for the approach of other animals during elimination, causing them to eliminate in a more open and safe area. Litter boxes that are too small, do not contain enough litter, or contain liners that are potentially aversive for cats with intact claws¹⁶ can also create an aversion to the elimination area. Substrate aversions may develop as a result of scented litters,²⁰ such as

aromatic pine or cedar shavings, or because of an unpleasant texture, such as large gravel or pellets.¹³ A common cause of litter box or substrate aversion is the experience of a painful bowel movement or urination from medical disease. Once the medical problem has resolved, the cat may still recall the unpleasant experience and, therefore, avoid the previously used litter box or substrate type.²¹ Signs of “dissatisfaction” with the litter box or substrate include a cat that investigates and then avoids entering a box, avoids digging and circling or covering waste while in the box, scratches the surrounding wall or sides of the litter box rather than the litter, and perches on the sides of the box.²² Moreover, cats with elimination problems spend less time digging²³ in the litter and are less likely to cover their waste.²⁰

Location Aversion

A location aversion can develop as the cat has a quarrel with another household cat, is startled by loud noise or commotion, or has difficulty accessing the elimination area. This can be a problem with multiple-cat households where social conflict may prevent some of the household cats from entering the designated elimination area. Geriatric cats may have difficulty accessing litter boxes²⁴ that require the cat’s ascending or descending a flight of stairs or hurtling gates or other obstacles that may have been set up to keep other animals or children from accessing the box. Litter box, substrate, and location aversions are not mutually exclusive and often there are multiple motivational diagnoses.

Substrate Preference

As the various aversions prevent cats from using their designated elimination areas, preferences for alternative substrates subsequently develop. For example, if the litter box is not scooped regularly and the cat chooses to eliminate on another clean substrate, it may develop a preference for the new, non-aversive material. Substrate preferences can develop with or

without the presence of an aversion and are most commonly associated with a preference for soft, absorbable material, such as bedding, piles of clothing, and linens.¹³ Less common are cats that prefer open, hard surfaces, such as wood or linoleum floors. Finally, cats with medical illness that may not have been able to reach the litter box may develop preferences for substrates on which they eliminated.¹³

Location Preference

Location preferences may develop as a result of a cat's desire for privacy, preference for a safe, quiet area, or ease of access to a specific location. Furthermore, cats are attracted to previously soiled areas³ and may be more likely to eliminate in a location where other cats have eliminated, or where the cat eliminated at a time when the litter box was not accessible. Owners may attempt to relocate the litter box and find the cat has a preference for the previous location.²¹

Anxiety

Each individual cat has a unique threshold for tolerating poor litter box management. Anxiety-provoking events and the presence of underlying stressors can change this threshold quickly. A cat who previously tolerated a dirty litter box or a difficult-to-access location may suddenly develop aversions or preferences with the addition of environmental stressors, such as new pets or people in the home, household renovations, or agonistic interactions with the owner or other cats. Furthermore, cats with anxiety about new household members or other household changes may be too nervous to venture to the location of their litter box.²⁴ Cats may also toilet outside of the litter box as a result of separation distress,²⁵ either during the work day or after an extended absence. Although anxiety is more commonly associated with urine marking, it is equally important to recognize when anxiety is playing a role in inappropriate toileting behaviors and to address accordingly.

Treatment

For urine-marking cats, neutering is recommended and should resolve the problem for 90% of males and 95% of females.¹⁵ For cats that urine mark while standing in the litter box, the addition of a vertical litter box placed so that the end of the horizontal box fits into it can create an acceptable place to urine mark.²¹ In addition, other forms of marking behavior such as scratch marking should be encouraged.²⁴ Substrates such as sisal-covered posts or real bark-covered logs in frequently visited areas of the home are appealing because they allow the cat to hook its claws in the material.²⁶ The remaining basic treatment principles are universal for both marking and inappropriate toileting behaviors and can work as an adjunct in treating medical elimination problems.

Litter Box Management

Cleanliness is crucial in successful litter box management. Proper litter box hygiene can improve both urine marking and inappropriate toileting behaviors.^{20,27} The box should be scooped daily and the contents fully emptied weekly,²⁷ allowing for washing with mild soap and water. Although plastic liners allow for easy and efficient cleaning, they should be avoided because they are potentially aversive for cats with intact claws.¹¹ Self-cleaning litter boxes offer increased cleanliness, but they are avoided by some cats because they are associated with aversive noise and movement. As far as litter type, cats have a natural preference for unscented and finely particulate litter material,¹⁰ making clumping litter a desirable option. Because strong perfumes and scents can create substrate aversions, unscented litter is preferred.¹³ In fact, one study found that the use of scented litter was associated with a higher incidence of elimination problems.²⁰ A recent study suggested that the addition of an odor eliminator (Zero Odor; Zero Odor, LLC, Pound Ridge, New York, USA) to standard clumping litter increased the attractiveness of the litter box and decreased the frequency of inappropriate eliminations.²²

Appropriate litter box size, shape, and location may also reduce the incidence of inappropriate elimination. Covered litter boxes may trap odors and prevent the cat from having a safe vantage point for the approach of other animals during elimination, making them a less desirable option for most cats. If, however, a covered box is being used by at least one cat, the owners should avoid immediately removing the covers from all boxes. Instead, a non-covered box can be placed next to a frequently used covered box to determine a preference for box type. If the covered box is then no longer used, it can be removed. Large, open boxes, such as plastic storage containers,¹² provide room for elimination posturing and pre-elimination/postelimination digging and covering behaviors. This principle of first offering the option of a new box and establishing a preference before removing old boxes that are being used by some of the cats in the home applies to all major litter box conformation changes. In multicat households, the number of litter boxes should equal the number of cats plus one additional box so that there is always a box available at any given time.¹² Each cat should have access to a litter box in a separate, safe, quiet area to prevent one cat's blocking another's access to the litter box location. This means owners should offer multiple location options for elimination, including at least one box on each floor of the house. Boxes should be kept at a distance from food and water bowls, as well as loud appliances, such as washer/dryers and furnaces that may have created a location aversion. See [Table 2](#) for details regarding litter box management.

Treatment of Soiled Areas

Because cats are attracted to previously soiled areas and may be inclined to overmark or use them for toileting,²¹ proper

Table 2. Basic Recommendations for Litter Box Management

Characteristic:	Ideal plan:
Size	Large enough to allow the cat to fully enter, circle, dig, eliminate, circle, and cover without touching the sides of the box
Covers	Most cats prefer no covers*
Linens	Avoid liners, especially for cats with intact claws
Litter type	Unscented, scoopable clay
Depth of litter	4-6 inches
Number of boxes	Number of cats + 1
Location	Multiple; every floor of home; easily accessible; quiet, low-traffic area
Scoop out waste	1-2 times daily
Empty entire contents and clean with soap and water	Once a week†
Automatic/self-cleaning litter box	Not recommended for noise-sensitive cats

*Some cats prefer covers. Offer an uncovered box next to a covered box to determine preference.

†Fastidious daily scooping may allow for longer time between cleaning.

cleaning is necessary. Although a variety of pet waste cleaning products exist, studies have shown that enzymatic cleaners are the most effective at reducing and preventing the return of urine odors.^{28,29} If the problem is chronic, the underlying carpet pads and baseboards may need to be replaced to completely eliminate excrement odors.¹³ Once the areas have been treated, the cat's ability to resoil them should be managed. This can be accomplished by placing plastic or foil coverings on top of them to create an unappealing tactile sensation when the cat walks in that area and to prevent resoaking of the carpet, should another elimination incident occur.^{13,27,30} Blocking access to bedding and picking up throw rugs and laundry are also important for cats with soft substrate preferences. Should the cat repeatedly soil a particular area despite these changes, it may be an indication of a location preference and a litter box should be placed directly on top of the soiled areas.

Confinement

In some cases the cat's access to previously soiled areas must be completely restricted. If the soiling is limited to one room in the home, that room can be closed off from access. If there are multiple areas or if the main area cannot be blocked off, then the cat should be confined to a room or "safe haven" when not directly supervised. Within this "safe haven" there should be fresh food and water, clean litter boxes, appropri-

ate scratching substrates, rotating toy options, and comfortable resting and perching sites³⁰ (Table 3). Owners should also take special care to provide daily social contact with the cat in this room, such as petting, brushing, or permitting time to sleep on the owner's lap.³¹ Confinement is also helpful in establishing substrate and box type preferences in that a "buffet" of options can be presented in one location. Various substrates, such as different brands of clay, potting soil, sand, shredded newspapers, and absorbable pads can be offered in multiple boxes, as well as varying box types.^{27,31} For cats with a preference for hard surfaces, flat pans or trays of differing material can be offered as well.¹⁶ When a cat has a strong aversion to a particular litter box or substrate based on a frightening or painful experience, the "buffet" of box options offered may need to be substantially different than the original box. Once a substrate and box preference has been established and the cat is eliminating appropriately, the preferred box/litter type can be used through the home and the cat's access to the home can be slowly expanded.^{12,13}

Reduction of Environmental Stressors

Because social distress and anxiety are common underlying components in urine marking for neutered cats, reducing stress and intercat conflict is key. A starting point for reducing stressors is providing 1) a living space that keeps the cat free from fear and distress and 2) a predictable daily routine and owner interactions over which the cat perceives it has some control.^{30,32,33} Cats should have full access to areas of the house where stressors, such as loud noises, dogs, other cats in the household, outdoor cats approaching the windows, and pursuit by small children, are minimized. Throughout the household, cats need perching options that offer safety and a decent vantage point above people and other animals. If the cat is agitated by cats outside the home, windows out which the cat has visual access should be blocked.²⁴ In multicat households there should be enough space for each cat to keep a social distance of at least 1 to 3 m³⁴ when they are in a room together. Some cats will rest together and groom/rub

Table 3. Checklist for Creating a Cat "Safe Haven." The Following Table Lists Recommendations for Creating a Safe Refuge for a Cat Inside the Home.

Litter boxes
Scratching options
Hiding places
High resting areas/perches
Fresh food and water
Interactive toys
Daily social contact with owners
Other pets in the home causing social conflict are denied access
Visual access to outdoor cats blocked
Soft music to muffle sounds outside of area
Pheromone diffuser

each other in an affiliative manner, while most cats use the same resting/perching sites at different times per day.³⁵ Hence, it is important to offer multiple safe and comfortable resting and hiding options.

One means of providing the individual cat with a low-stress environment is to set up a refuge from household stressors. Each cat should have access to its own quiet area of the home or “safe haven” (Table 3). Electronic cat doors can be installed to allow access only to the individual cat wearing the door-activating collar.²¹ In single-cat households, a baby gate raised several inches in the door jamb will permit the cat to enter the room, keeping out dogs and small children.

Punishment

Punishment should be avoided in both marking and toileting problems. Because many elimination problems are based in anxiety or social conflict, punishment is likely to exacerbate the problem. Should an owner catch a cat in the act of eliminating outside of the box, the behavior can be calmly interrupted with as little movement as possible on the owner’s part.¹⁶ In the author’s experience, teaching the cat an “interruptor” cue and then redirecting the cat to an appropriate elimination site can be beneficial. The interruptor cue is taught pairing a sound (nonstartling), such as the shaking or crinkling of a treat pouch or the jingling of a bell, with the cat’s favorite food treat, a process known as classical conditioning.³⁶ Once conditioned, the owner can use this cue to interrupt early elimination postures, call the cat away from its intended elimination area, and then give the food reward for compliance. For cats with inappropriate toileting problems, they can then be calmly taken to the litter box and praised and given another food treat for appropriate elimination.²¹ This method gives the owner a means of stopping undesirable elimination without causing fear or anxiety, keeping the owner-cat bond intact.

Pheromones

The pheromone product Feliway (Ceva Animal Health, Inc., St. Louis, Missouri, USA) has been shown to reduce the occurrence of urine marking as well as to increase relaxed behavior in stressful environments.³⁷⁻⁴¹ Hence, its use may be beneficial in cases in which stress or anxiety is an underlying factor in the elimination problem. Feliway is an analog of the facial pheromone deposited when cats facially rub or bunt on objects—a behavior performed when cats feel comfortable with their environment.⁴² Because cats do not typically urine mark in locations where they have deposited facial pheromones, it serves as an antagonist of urine marking. For cases of urine marking, Feliway can be sprayed directly to marked areas 1 to 3 times daily.³⁹ Alternatively, a plug-in diffuser can be used to obtain a broader and more consistent distribution of the pheromone product in a particular room of the home.⁴⁰

Drug Therapy

Early studies indicated moderate efficacy with the use of progestins for urine marking in cats.^{43,44} Because of the high potential for adverse effects, such as diabetes mellitus and bone marrow suppression,⁴⁵ and the development of safer, more effective drugs, progestin treatment has fallen out of favor. The benzodiazepine, diazepam, was found to reduce urine marking in 55% of treated cats⁴³; however, accounts of acute fulminant hepatic failure after oral administration have been reported,^{46,47} making its use potentially hazardous. Later, treatment with the azapirone, buspirone (0.5-1 mg/kg every 12 hours⁴⁵), showed some promise in controlling urine marking in multiple-cat households,⁴⁸ but reports of increased intercat aggression problems have been published.⁴⁹ More recently, several studies have demonstrated efficacy of clomipramine (0.25-1.3 mg/kg every 24 hours⁴⁵) in treating urine marking in cats.⁵⁰⁻⁵² Clomipramine is a tricyclic antidepressant whose serotonin-enhancing properties are effective at reducing anxiety.⁴⁵ Side effects may include sedation, constipation, urine retention, pupil dilation, and appetite changes. Daily doses less than 0.5 mg/kg are associated with fewer side effects.⁵⁰ Even greater efficacy for the treatment of urine marking can be gained with the use of the selective serotonin reuptake inhibitor fluoxetine (0.5-1.5 mg/kg every 24 hours⁴⁵). In fact, one study found that 100% of cats treated with 1 mg/kg of oral fluoxetine once daily had a 90% or greater reduction in marking behaviors.⁵³ Because the selective serotonin reuptake inhibitors as a class are more selective for serotonin enhancement and do not have major anticholinergic/anti-adrenergic properties, fluoxetine is associated with fewer side effects than the tricyclic antidepressants, with decreased appetite and lethargy being the most common. Suppression of appetite is of concern, especially with finicky eaters or obese cats; therefore, caution should be exercised with fluoxetine use in such cases. Finally, a pilot study using the dietary supplement (Anxitane; Virbac Animal Health, Fort Worth, Texas, USA) containing L-theanine has shown promise in treating anxiety problems in cats, including inappropriate elimination.⁵⁴ L-theanine is an amino acid found in green tea and has been shown to promote mental and physical relaxation in humans.⁵⁵ Further studies are needed to determine its safety and efficacy in feline elimination problems.

Regardless of drug class, efficacy, or side effects, it is important to recognize that no psychotropic drugs are labeled for use in cats. Cat owners should be made aware of the off-label use and cautioned regarding potential side effects and toxicities. In addition, the use of psychotropic drugs should be an adjunct to environmental changes and proper litter box management. The precise starting dose and duration of drug therapy vary with each cat. Starting at or below the published dose range and titrating up to effect over several weeks is recommended. Typically, several months at the maintenance dose are necessary to obtain acceptable resolution. Once the new elimination habits have developed and been maintained for 2 to 3 months, the medication can be

reduced in gradual increments and discontinued.⁴⁵ Owners should also be counseled on proper drug administration because stressing the cat during “pilling” will be counterproductive to the treatment plan. Disguising medication with palatable food or compounding into flavored liquids or treats is recommended. Furthermore, a minimum baseline database, including a complete blood count, serum chemistry profile, total T4, and urinalysis should be performed on all inappropriately eliminating cats, especially before starting off-label use of a psychotropic drug. Organ screening tests should then be monitored regularly if the drug is maintained long term.

Concluding Remarks

Feline inappropriate elimination is a complex issue and, untreated, may lead to deterioration of the owner-cat bond and subsequent relinquishment or euthanasia. Fortunately, our understanding of this behavior is progressing and promising treatment options are available. The role of underlying medical disease and environmental stressors is undeniably strong and every effort should be made to address it. Obtaining a thorough history, performing a comprehensive physical evaluation, and designing a treatment plan catered to the individual cat and home environment are the cornerstones of success.

References

- Salman M, Hutchison J, Ruch-Gallie R, et al: Behavioral reasons for relinquishment of dogs and cats to 12 shelters. *J Appl Anim Welf Sci* 3:93-106, 2000
- Casey R, Vandebussche S, Bradshaw J, et al: Reasons for relinquishment and return of domestic cats (*Felis sylvestris catus*) to rescue shelters in the UK. *Anthrozoos* 22:347-358, 2009
- Borchelt P, Voith V: Elimination behavior problems in cats, in Borchelt P, Voith V (eds): *Readings in Companion Animal Behavior* (vol 1). Trenton, New Jersey, Veterinary Learning Systems, pp 179-190, 1996
- Mertens PA, Dodman NH: The diagnosis of behavioral problems in dogs, cats, horses and birds: characteristics of 323 cases (July 1994-June 1995). *Kleintierpraxis* 41:259-266, 1996
- Bamberger M, Houpt KA: Signalment factors, comorbidity, and trends in behavior diagnoses in cats: 736 cases (1991-2001). *J Am Vet Med Assoc* 229:1602-1606, 2006
- Amat M, de la Torre JLR, Fatjo J, et al: Potential risk factors associated with feline behaviour problems. *Appl Anim Behav Sci* 121:134-139, 2009
- Buffington CAT, Westropp JL, Chew DJ, et al: Clinical evaluation of multimodal environmental modification (MEMO) in the management of cats with idiopathic cystitis. *J Feline Med Surg* 8:261-268, 2006
- Seawright A, Casey R, Kiddie J, et al: A case of recurrent feline idiopathic cystitis: the control of clinical signs with behavior therapy. *J Vet Behav* 3:32-38, 2008
- Halip JW, Vaillancourt JP, Luescher UA: A descriptive study of 189 cats engaging in inappropriate elimination behaviors. *Feline Pract* 26:18-21, 1998
- Turner DC, Bateson PPG: *The Domestic Cat: The Biology of Its Behaviour* (ed 2). New York, 79-86, Cambridge University Press, pp
- Wemmer C, Scow K: Communication in the Felidae with emphasis on scent marking and contact patterns, in Sebeok T (ed): *How Animals Communicate* (vol 1). Bloomington, Indiana, Indiana University Press, pp 749-766, 1977
- Neilson JC: Feline house soiling: elimination and marking behaviors. *Vet Clin North Am (Small Anim Pract)* 33:287-301, 2003
- Overall KL: Diagnosis and treating undesirable feline elimination behavior. *Feline Pract* 21:11-15, 1993
- Feldman HN: Methods of scent marking in the domestic cat. *Can J Zool* 72:1093-1099, 1994
- Hart BL, Cooper L: Factors relating to urine spraying and fighting in prepubertally gonadectomized cats. *J Am Vet Med Assoc* 184:1255-1258, 1984
- Landsberg GM, Hunthausen WL, Ackerman LJ: Feline house soiling, in Landsberg GM, Hunthausen (eds): *Handbook of Behavior Problems of the Dog and Cat* (ed 2). New York, Saunders, pp 365-384, 2003
- Halip JW, Luescher UA, Mckeown DB: Inappropriate elimination in cats, part 1. *Feline Pract* 20:17-21, 1992
- Skeritt GC, Jemmett JE: The spraying problem. Results and analysis of the Glaxovet/FAB survey. 18:3-4, 1980
- Marder AR: House soiling. *Pet Vet* 4:6-10, 1992
- Horwitz DF: Behavioral and environmental factors associated with elimination behavior problems in cats: a retrospective study. *Appl Anim Behav Sci* 52:129-137, 1997
- Cooper LL: Feline inappropriate elimination. *Vet Clin N Am (Small Anim Pract)* 27:569-600, 1997
- Cottam N, Dodman NH: Effect of an odor eliminator on feline litter box behavior. *J Feline Med Surg* 9:44-50, 2007
- Sung W, Crowell-Davis SL: Elimination behavior patterns of domestic cats (*Felis catus*) with and without elimination behavior problems. *Am J Vet Res* 67:1500-1504, 2006
- Neilson J: Thinking outside the box: feline elimination. *J Feline Med Surg* 6:5-11, 2004
- Schwartz S: Separation anxiety syndrome in cats: 136 cases (1991-2000). *J Am Vet Med Assoc* 220:1028-1033, 2002
- Houpt KA: *Domestic Animal Behavior for Veterinarians and Animal Scientists* (ed 4). Ames, Iowa, Blackwell Publishing, p 30, 2005
- Marder AR, Engel JM: Long-term outcome after treatment of feline inappropriate elimination. *J Appl Anim Welf Sci* 5:299-308, 2002
- Beaver BV, Terry ML, Lasagna CL: Effectiveness of products in eliminating cat urine odors from carpet. *J Am Vet Med Assoc* 194:1589-1591, 1989
- Melese P: Detecting and neutralizing odor sources in dog and cat elimination problems. *Appl Anim Behav Sci* 39:188-189, 1994
- Overall KL, Rodan I, Beaver BV, et al: Feline behavior guidelines from the American Association of Feline Practitioners. *J Am Vet Med Assoc* 227:70-84, 2005
- Olm DD, Houpt KA: Feline house-soiling problems. *Appl Anim Behav Sci* 20:335-345, 1988
- Broom DM, Johnson KG: *Stress and Animal Welfare* (ed 1). London, Chapman & Hall, pp 111-144, 1993
- Carlstead K, Brown JL, Strawn W: Behavioral and physiological correlates of stress in laboratory cats. *Appl Anim Behav Sci* 38:143-158, 1993

34. Barry KJ, Crowell-Davis SL: Gender differences in the social behavior of the neutered indoor-only domestic cat. *Appl Anim Behav Sci* 64:193-211, 1999
35. Bernstein PL, Strack M: A game of cat and house: spatial patterns and behavior of 14 domestic cats (*Felis catus*) in the home. *Anthrozoos* 9:25-39, 1996
36. Mills D: Learning, training and behaviour modification techniques, in Horwitz D, Mills D, Heath S (eds): *BSAVA Manual of Canine and Feline Behavioural Medicine*, Gloucester, BSAVA, pp 37-48, 2002
37. Griffith CA, Steigerwald ES, Buffington CAT: Effects of a synthetic facial pheromone on behavior of cats. *J Am Vet Med Assoc* 217:1154-1156, 2000
38. Hunthausen W: Evaluating a feline facial pheromone analogue to control urine spraying. *Vet Med* 95:151-155, 2000
39. Frank DF, Erb HN, Houpt KA: Urine spraying in cats: presence of concurrent disease and effects of a pheromone treatment. *Appl Anim Behav Sci* 61:263-272, 1999
40. Mills DS, Mills CB: Evaluation of a novel method for delivering a synthetic analogue of feline facial pheromone to control urine spraying by cats. *Vet Rec* 149:197-199, 2001
41. Kakuma Y, Bradshaw J: Effects of a feline facial pheromone analogue on stress in shelter cats. *Proceedings of the 3rd International Congress on Veterinary Behavioural Medicine*, Vancouver, British Columbia, 218-220, 2001
42. Pageat P, Gaultier E: Current research in canine and feline pheromones. *Vet Clin N Am (Small Anim Pract)* 33:187-211, 2003
43. Cooper L, Hart BL: Comparison of diazepam with progestin for effectiveness in suppression of urine spraying behavior in cats. *J Am Vet Med Assoc* 200:797-801, 1992
44. Hart BL: Objectionable urine spraying and urine marking in cats—evaluation of progestin treatment in gonadectomized males and females. *J Am Vet Med Assoc* 177:529-533, 1980
45. Crowell-Davis SL, Murray T: *Veterinary Psychopharmacology* (ed 1). Ames, IA, Blackwell Publishing, pp 16, 80-107, 179-206, 2006.
46. Center SA, Elston TH, Rowland PH, et al: Fulminant hepatic failure associated with oral administration of diazepam in 11 cats. *J Am Vet Med Assoc* 209:618-625, 1996
47. Hughes D, Moreau R, Overall K, van Winkle T: Acute hepatic necrosis and liver failure associated with benzodiazepine therapy in six cats. *J Vet Emerg Crit Care* 6:13-20, 1996
48. Hart BL, Eckstein RA, Powell KL, et al: Effectiveness of buspirone on urine spraying and inappropriate urination in cats. *J Am Vet Med Assoc* 203:254-258, 1993
49. Lindell EM, Erb HN, Houpt KA: Intercat aggression: a retrospective study examining types of aggression, sexes of fighting pairs, and effectiveness of treatment. *Appl Anim Behav Sci* 55:153-162, 1997
50. King JN, Steffan J, Heath SE, et al: Determination of the dosage of clomipramine for the treatment of urine spraying in cats. *J Am Vet Med Assoc* 225:881-887, 2004
51. Landsberg GM, Wilson AL: Effects of clomipramine on cats presented for urine marking. *J Am Anim Hosp Assoc* 41:3-11, 2005
52. Hart BL, Cliff KD, Tynes VV, et al: Control of urine marking by use of long-term treatment with fluoxetine or clomipramine in cats. *J Am Vet Med Assoc* 226:378-382, 2005
53. Pryor PA, Hart BL, Cliff KD, et al: Effects of a selective serotonin reuptake inhibitor on urine spraying behavior in cats. *J Am Vet Med Assoc* 219:1557-1561, 2001
54. Dramard V, Kern L, Hofmans J, et al: Clinical efficacy of L-theanine tablets to reduce anxiety-related emotional disorders in cats: a pilot open-label clinical trial. *Proceedings of the 6th International Congress on Veterinary Behavioural Medicine*, Riccione, Italy, pp 114-115, 2007
55. Juneja LR, Chu DC, Okubo T, et al: L-theanine—a unique amino acid of green tea and its relaxation effect in humans. *Trends Food Sci Tech* 10:425-425, 1999