

Feline Aging

Promoting Physiologic and Emotional Well-Being



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KEYWORDS

• Feline aging • Gerontology • Cognitive dysfunction • Dementia

KEY POINTS

- With more cats living to advanced age, understand changes associated with aging is of growing importance, especially those that result in emotional or physical distress.
- Behavioral changes such as increased vocalization (especially at night) and house soiling are commonly reported in elderly cats and occur for different reasons.
- Diagnosis of illness in elderly cats can be challenging, with many older cats suffering from concurrent medical conditions, often complicated by normal aging changes.
- Elderly cat clinics play a crucial role in educating owners and facilitating early diagnosis and treatment of medical or behavioral problems.
- Adapting the environment of elderly cats to provide all key resources within easy comfortable access can significantly improve their quality of life.

 Video content accompanies this article at <http://www.vetsmall.theclinics.com>.

INTRODUCTION

Advances in veterinary medicine, nutrition and client education have increased the life expectancy for domestic cats. In the United States, in 2011, approximately 20% of pet cats were 11 years of age or older¹; and a 2017 study reported a median age of 6.2 years in cats presenting to clinics in the UK, with cats aged more than 8 years representing just more than 40% of feline consultations.²

Older cats are classified as mature (7–10 years), seniors (11–14 years), and geriatric or super senior (≥ 15 years).³ For the purposes of this article, we refer to all cats 11 years or older as “elderly.”

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Box 1**Aging changes in elderly cats—outward changes that owners need to look for plus inward changes that veterinarians need to assess**

- The *body condition score* (BCS) and *muscle condition score* (MCS) may decrease—the MCS may indicate the degree of sarcopenia that is common in elderly cats (see [Fig. 1](#))
- Aging changes: *eyes* (iris atrophy [[Fig. 13A](#)], lenticular sclerosis see [[Fig. 13B](#)],⁵⁶ and blindness); *ears* (accumulating wax or deafness); and *coat* (white hairs, browning of a black coat, poor grooming because of underlying OA and/or dental disease).¹
- *Dental disease*—although not specific to elderly cats, assess gingivitis, periodontal disease, tartar, tooth resorption, etc.
- *Thyroid nodules*—it is essential to palpate for asymmetry or enlargement in elderly cats.
- *Jugular pulse*—this is usually an indicator of incipient or active congestive heart failure ([Video 1](#)). The *hepatojugular reflex/reflux* makes it easier to identify this problem. Gently compress the liver to move blood into the thoracic vasculature. If the heart cannot cope, the jugular pulse becomes more obvious and moves up the jugular groove.
- *Auscultation of the apex beat*—this gives heart rate and an indication of the severity of heart murmurs; in elderly cats, the heart falls forward, so auscultate over the sternum to detect murmurs and gallop sounds. Feel for *matched pulses*—because elderly cats often do not like their femoral pulses palpated (owing to OA in the hips and/or stifles) carpal and tarsal pulses are alternate options.
- The *respiratory tract* should be assessed by *looking* (for evidence of inspiratory or expiratory dyspnea, a restrictive, or obstructive pattern), *listening* (to localize any respiratory pathology), *palpation* (the apex beat is usually palpated nearer the sternum in older cats), *compression* (usually reduced in older cats because of costochondral junction mineralization), *percussion* (can be uncomfortable if the cat has bony changes in the thoracic spine), then *auscultation* (listening for all of the potential changes that can occur in cat chests).
- *Abdominal examination*—can be particularly useful in slim, elderly cats.
- *Skeletal examination*—typically reveals OA of many joints; elbow, stifles and hocks often have large bony periarticular exostoses, with elbows held from the body and carpi collapsing inwards ([Fig. 14](#)). Stifles are also held away from the body, and the hocks and/or tarsi collapse.
- *Nails* may be thickened, brittle, overly long or ingrown (see [Fig. 2](#)).

Meeting the needs of this aging population can be a challenge for owners and veterinarians alike. This article explores some of the common conditions of elderly cats, with a focus on promoting physiologic and emotional well-being.

THE AGING PROCESS

Aging is a multifaceted process that results in a progressive series of life stages, from conception to senescence. It is influenced by the host's genetics, plus innumerable internal and external factors.¹ It results in the progressive decline in the ability to maintain homeostasis when challenged by physiologic and environmental stressors.¹ Because these factors include previous injuries, disease, nutritional status, and environmental challenges, every cat ages slightly differently.

Although it is important to remember that old age itself is not a disease and clients should promote healthy aging, they also need to recognize often subtle signs of ill-health. Regular health screening can increase the chance of disease being recognized early, so appropriate treatment can be initiated.



Fig. 1. Elderly cat with sarcopenia of aging.

Common Physiologic and Behavioral Changes in Aging

Although some changes are obvious (**Box 1**) such as a decline in lean muscle mass (sarcopenia; **Fig. 1**), and thickened brittle nails that are prone to overgrowth (**Fig. 2**), others are less apparent, including alterations in digestive physiology, the immune system, kidneys, liver, brain, and skeleton.¹

Sensitivity to Socioenvironmental Stress

Older cats cope poorly with changes in their daily routine, environment, family, or diet (discussed elsewhere in this article). Their response to stress typically involves hyporexia, hiding, and/or house soiling. It is important to consider the potential for stress when planning changes to a cat's regimen and, when changes are necessary, making them slowly and with much reassurance. All cats, especially elderly cats, should be given a box or bed to hide in—a safe haven⁴ (**Fig. 3**). There are many ways to improve the environment for elderly cats, including ensuring that all of their key resources are within easy reach and suitable for an elderly cat to use (**Box 2**).

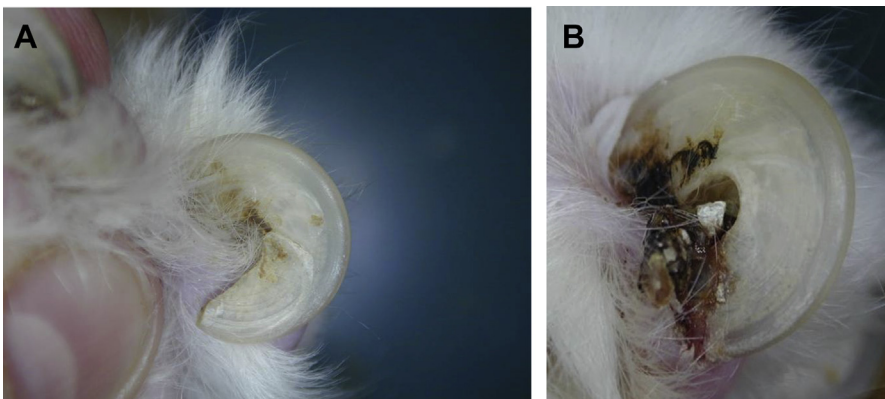


Fig. 2. (A) Elderly cats can develop long thick brittle nails (B) that become ingrown.



Fig. 3. Elderly cats need somewhere safe to hide in at home—a safe haven.

Changes in Body Weight

A cat should be weighed at each clinic visit (**Fig. 4**); it is essential to calculate the percentage weight change each time (**Box 3**)—it is very easy to miss significant changes in small cats. Significant ($\geq 5\%$) and/or rapid weight change, especially where muscle mass is lost, can have very serious implications, irrespective of the underlying cause.⁵ Cats should be fed to maintain their optimal body weight and muscle mass; long-term studies have shown that both obesity and emaciation increase morbidity and mortality.⁶

Obesity decrease life span, and increases the risk of weight-related diseases, including heart disease, diabetes mellitus (DM), lameness (often owing to osteoarthritis [OA]), liver disease (eg, hepatic lipidosis), and skin problems.⁷

Weight loss is more common in elderly cats than obesity,⁸ resulting from physiologic aging changes, pathologic processes, and/or behavioral changes.⁹ Most cases are associated with hyporexia, which may result from reduced senses of smell and taste, pain from periodontal disease, and a myriad of illnesses associated with age.¹ However, sarcopenia, the loss of lean muscle mass in the absence of apparent disease,¹⁰ may also occur. Elderly cats digest food inefficiently; they have decreased gastric acid production, pancreatic lipase activity, intestinal motility, and blood flow, as well as changes in bile composition.¹¹ Digestion and absorption of all dietary components is decreased (particularly fats and proteins), such that individuals may need to increase their intake by up to 25%.¹² Because elderly cats have a limited stomach capacity, they need to eat a highly palatable, highly digestible, energy-dense food, with an increased proportion of protein calories in an attempt to increase (or prevent the loss of), lean muscle mass. Food should be offered frequently, in small amounts

Box 2**Environmental adjustments for elderly cats**

Adjustments to the environment and daily routine may promote the psychological well-being of elderly cats. *Key Resources* are food, water, resting places, litter box, scratching substrates, a place to hide and an escape route. All of these should be provided within the cats' core territory.

A. Promoting physiologic well-being (provision of key resources)

- There should be at least 1 set of key resources (with the exception of food bowls, which should be per cat) for each social grouping of cats in the household, plus at least 1 extra. A group of cats is one where cats will comfortably groom each other and sleep together (Fig. 15).
- Key resources must be easily accessible. If an elderly cat has to walk too far for its food or water or stairs are involved, it may do without, risking weight loss and dehydration. If it has to walk too far for its litter box, it may resort to house soiling.
- Key resources should not be moved from their usual place because this can cause confusion and anxiety in a cat with CDS.
 - Food
 - Elderly cats should be fed separately from conspecifics so they are not stressed by their companions and can eat at their own pace (Fig. 16).
 - Food bowls should be away from water bowls and litter boxes.
 - Automatic feeders (to provide additional meals) may help to decrease vocalizations associated with food seeking (Fig. 17).
 - Raising food bowls can help to decrease discomfort in cats with OA (Fig. 18).
 - Elderly cats have a decrease ability to digest and absorb their food—to reduce the risk of weight loss feed *ad libitum* or increase the frequency of feeding; this can be also be helpful for cats with cognitive decline.
 - Monitor how much food elderly cats eat to make sure that they do not lose weight.
 - Water
 - Elderly cats may prefer a wide bowl if they have poor vision because they can then agitate the water with a paw to help sense the surface—placing a few flakes of fish food on the water can help them to see or sense it if OA prevents them from using their paw in this way.
 - Raising water bowls can help to decrease discomfort in cats suffering from OA.
 - Pet water fountains can help to stimulate elderly cats to drink more (Fig. 19) or give fishy water, chicken or meat stock (without onion powder), or commercial soups for cats.
 - Water bowls should be placed away from food bowls and litter boxes.
 - Resting places
 - Ensure resting areas are well-padded and consider providing heated bedding for cats with OA, a thin condition, or a sparse hair coat.
 - Consider ease of access to favored resting areas (or hiding places) and provide steps/ramps where possible, or lower level alternatives.
 - Climbing frames provide welcome high resting places (see Fig. 20).
 - Litter boxes or access to outdoor latrine sites
 - Larger litter boxes with a low entrance allow ease of access (Fig. 21).
 - Litter boxes need to be easily reached; there should be at least 1 litter box on each floor of the house.
 - Sandy-type litter is usually more comfortable for elderly cats with OA affecting the paws. Litter box liners should not be used because nails may become caught in elderly cats that cannot retract their nails.
 - Elderly cats that go outside to eliminate may find climbing through the cat flap challenging.
 - Elderly cats that go outside may find confronting cats from outside the family group challenging. If cats still want to keep going outside, ensure there is enough “cover” for them to get to the latrine site; place large planters near the cat flap so the cat can go outside under their cover. Alternatively, “cat-proof” the garden with high fencing so that other cats cannot get in (Fig. 22). Cats usually have a preferred latrine site—digging in sand will make it easier for an elderly cat to use, especially in winter.

- Scratching places
 - All cats need access to at least 1 scratching post. Whereas younger cats usually prefer vertical posts, elderly cats may prefer horizontal ones (Fig. 23).
 - Cats may show preferences for different substrates, for example, carpet, mats.
 - Older cats cannot scratch sufficiently well to remove their overgrown nail sheaths, so they will need to have their nails trimmed to prevent them from getting caught, causing pain in arthritic paws, and confusion in cats with CDS (Section 7).
- Grooming
 - Extra grooming may become increasingly necessary in elderly cats. Although it is well-tolerated by some and can promote the human–animal bond, it is less well-tolerated by others and the preferences of the individual cat should always be respected.
 - Soft grooming brushes are often better tolerated than metal combs, and clipping areas that are getting matted can improve comfort.

B. Increasing environmental security

- Hiding places
 - Secure indoor hiding places or “safe havens” are very important in elderly cats because the option to escape outdoors may be less accessible or appealing. Hiding places need to be easily accessible for the cat; consider ramps or steps.
 - The cat must have time alone without being disturbed by other animals or owners. Avoid negative associations (eg, medicating), because this will compromise the cat’s feeling of security.
- Changes to core territory
 - Core territory may need to be reduced in cats with reduced mobility, or sensory or cognitive decline, especially with advanced CDS. If this is the case, key resources should be kept within easy reach and in a consistent location.
 - Provide a separate core territory from conspecifics, especially if social dynamics have altered.
 - Install a night light if loss of vision is a concern.
 - A synthetic analogue of feline facial pheromone (eg, Feliway Classic) may help to decrease anxiety.
- Outdoor access
 - It may be necessary to control access outdoors in cats with decreased mobility, or sensory or cognitive decline.
 - Consider providing a secure outdoor area for cats who are used to having access outdoors.
 - The presence of the owner can help to increase confidence in older cats when outdoors (Fig. 24).

C. Optimizing social relationships

- Human interaction
 - The desire for human interaction varies greatly between cats, but older cats generally seek human contact (see Fig. 7).
 - Where human contact is sought, this should be offered in a consistent and predictable way, and never forced. Where a cat is used to being lifted up, this may need to be tailored to cope with progressive OA.
 - Condition owner interaction by using a removable item such as a blanket or towel to help decrease attention-seeking behavior (Fig. 25); this can also decrease the risk of overgrown cat nails hurting the owner, making them stop the interaction abruptly, potentially damaging the relationship, and confusing the cat.
- Interaction with conspecifics and other animals
 - Tolerance of conspecifics and other animals within the household may decrease with age (see Fig. 7). Provide separate resources and core territories so that interaction can be avoided when desired. Consider using microchip-controlled cat flaps to allow access to a quiet space (eg, under stair cupboard) or adapt an elevated position if the conspecific(s) are not as agile (see Fig. 16).
 - Pheromone products (eg, Feliway Friends) may help to decrease tension between conspecifics arising when an elderly cat develops behavioral or physical changes; the provision of space and resources must also be appropriate.

- The loss of a long-time companion may result in grief in some elderly cats, (especially Burmese and Siamese); they will need reassurance and comfort. Introducing a new cat or dog can be very stressful, especially for elderly cats. Do not presume that because a cat is grieving they will welcome a new animal into the household.
 - Routine
 - Routine is particularly important for cats with cognitive decline or chronic medical conditions, which increase susceptibility to environmental stress.
 - Keep feeding times, access to the outdoors (if applicable), and schedule of owner interaction (tailored to cats' individual needs) as consistent as possible.
- D. Providing for species-specific and cognitive needs
- Outlets for hunting and seeking drive
 - Mental stimulation decreases the rate of decline of cognitive function in aged animals.⁵⁷
 - Provide opportunities for searching, chasing, and pouncing by using a combination of scatter feeding and food puzzles (shop bought or homemade; [Fig. 26](#), www.foodpuzzlesforcats.com, Delgado and Dantas, Feeding Cats for Optimal Mental and Behavioral Well-Being, Part 2). Ensure short play sessions involving a range of different toys are incorporated into the daily routine. Ensure all puzzles and play account for mobility issues, especially elbow OA.
 - Toys should be changed regularly to create stimulation and need to be suitable for elderly cats: blind cats will need toys that make a noise (eg, have a bell inside), whereas cats with arthritis will need light-weight, easily lifted toys ([Fig. 27](#)).
 - Olfactory enrichment
 - This benefits cats of all ages. It is important to be mindful of the scent profile of the cats' environment. Avoid smoke, scented candles, air fresheners, and chemical cleaning products.
 - Offer access to fresh air, where possible, and consider enclosed outdoor areas ('catios') for indoor cats.
 - Consider providing an herb box containing cat-friendly plants and herbs for elderly cats who have limited exposure to the outdoors.
 - Catnip, silver vine, honeysuckle, and valerian root have all been shown to provoke a positive behavioral response from cats. However, some cats are more sensitive than others to these plants (or their products), so they should be introduced carefully to elderly cats, especially if they have decreased mobility.
 - Cats can quickly habituate to scents within the environment, so intermittent exposure to varied scents is likely to increase engagement



Fig. 4. Always weigh the cat and calculate percentage weight change; if there is a 5% or greater loss, investigation is essential. (Courtesy of J. Burn, Congleton, UK.)

Box 3**Calculation of the percentage weight loss**

Cat's previous weight (x kg) – cat's current weight (y kg) = z (z/x) \times 100 = % weight change

For example, $4.0-3.7 = 0.4/4.0 = 0.1$ $0.1 \times 100 = 10\%$

with the aim of supporting optimal body weight.⁹ Although it is often assumed that elderly cats have a degree of chronic kidney disease (CKD) and may benefit from moderate protein restriction, inappropriate protein decreases risk protein malnutrition, with progressive loss of lean body mass being of particular concern.⁹

Feeding small meals frequently also increases physical activity, which is good for the musculoskeletal system and brain activity.¹³

Diets supplemented with antioxidants and free radical scavengers (eg, glutathione, vitamins A, C, and E, taurine, carotenoids, and selenium), essential fatty acids, and other potentially useful compounds, such as prebiotics, have been shown to benefit elderly cats.¹⁴

Sensitivity to Thirst

Elderly cats have decreased sensitivity to thirst.¹⁵ This increases their risk of dehydration, especially when combined with the polyuria associated with concurrent CKD, hyperthyroidism, and DM. Dehydration contributes to constipation, which is common in older cats,¹⁶ and exacerbated by concurrent OA if the cat is reluctant to use its litter box or catflap. Where possible, elderly cats should be fed mostly wet food and have easy access to fresh water in a variety of forms (see **Box 2**).

Changes in Immune Function

Immunosenescence with age results in a reduced ability to fight infection and screen for neoplastic cells.¹⁷ For example, in younger cats less than 15% of cystitis is bacterial, compared with approximately 50% in cats 10 years or older.¹⁸ These infections are often associated with CKD, hyperthyroidism, or DM, all of which are common in older cats, and result in less concentrated urine plus local and/or systemic immunosuppression.^{19,20}

Changes in Pharmacodynamics

Aging changes affect drug metabolism. Liver disease, low blood albumin concentration, and CKD all occur commonly in elderly cats. When coupled with dehydration, they can result in decreased drug clearance rates and marked increases in drug concentrations.²¹ In elderly patients, the dose and dosing intervals of some drugs may need to be altered (**Box 4**).

Box 4**Changing drug dosages in cats with kidney or liver disease**

- As a general rule, it is best to *double the dosing interval or halve the dosage* in patients with severe CKD; and use the least toxic drugs.
- Many factors affect drug clearance by the liver, so it is not possible to apply a simple formula to drug dosing with severe *hepatopathy*. However, there are tables available that have been adapted from human literature.⁵⁸
- A common example is metronidazole, which might be needed, for example, for suppurative cholangitis. It would need to be reduced to 7.5 mg/kg every 12 hours, rather than 10 to 15 mg/kg every 12 hours for cats with normal liver function

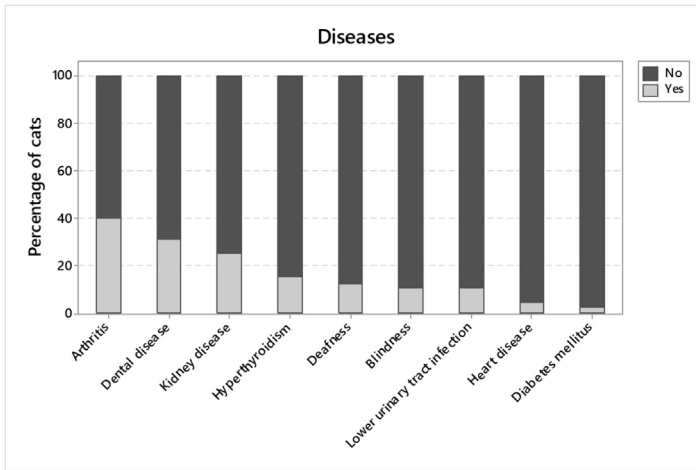


Fig. 5. Common chronic disorders in elderly cats—as per their owners.

Changes in the Musculoskeletal System

Lean muscle loss, joint degeneration, and OA should never be overlooked because their negative effects in elderly cats can be considerable (see **Box 2** in Beatriz Monteiro's article, "Feline Chronic Pain and Osteoarthritis" in this issue).

It is beyond the scope of this article to cover all aging changes; however, 2 detailed reviews of aging in cats have recently been published, describing common physical and functional changes, and describing what is healthy and what is disease.^{1,22}

MEETING THE PHYSICAL NEEDS OF AGING CATS

Keeping elderly cats comfortable can require significant environmental modification (see **Box 2**) and management changes, some of which are discussed further in this article.

Nail Care

Elderly cats cannot fully retract their nails, and concurrent OA may decrease their capacity to remove old nail sheaths by scratching. Overgrown nails may pierce the pads (see **Fig. 2**) or get caught in fleecy blankets, causing distress and pain when arthritic

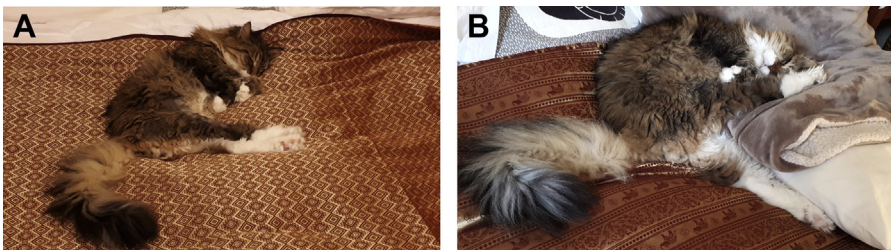
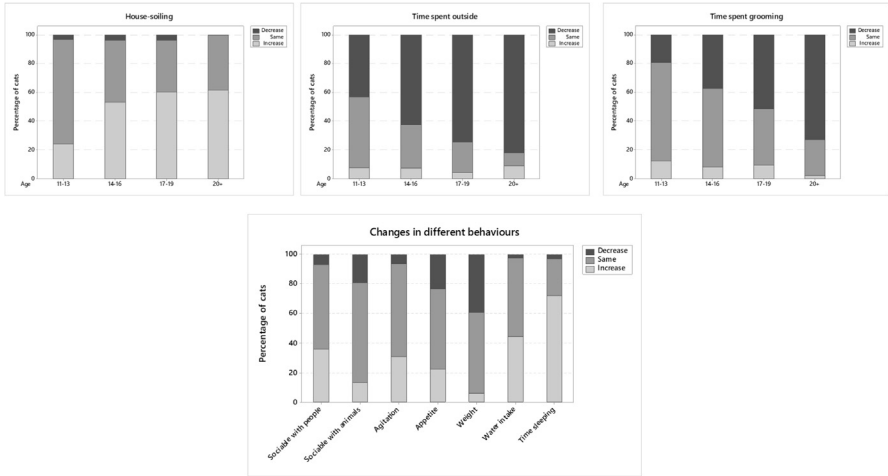


Fig. 6. (A) Elderly cat with hip and stifle OA. The fur over his hips has been clipped because he could not groom it anymore. (B) Unusual position of his tail and hips because of pain and dysfunction; separated legs to take pressure off hip.



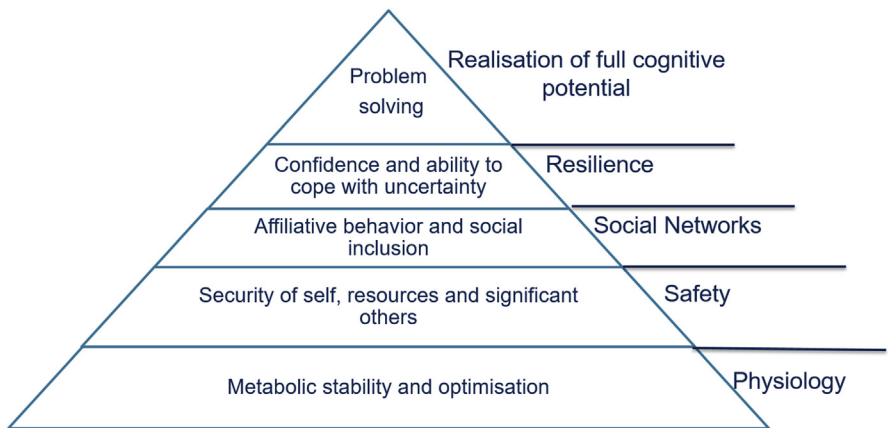
Owner reported changes in behaviour by their cats aged ≥11 y old, n=>800 (Sordo et al 2020a).

Fig. 7. Changes in behavior in elderly cats—as per their owners.

joints are tugged. Owners need to know how to clip their cat’s nails (or to have the clinic nurse do so) and monitor for ingrown nails.

Osteoarthritis

Arthritis is common in elderly cats. One study found radiographic evidence of OA in 61% of cats aged 6 years or older; the prevalence increased with age and was associated with decreased mobility and grooming, as well as increased house soiling.²³ A study found owners recognized OA in 40% of cats aged 11 or more years (Fig. 5),



Reproduced from Mills et al (2012)

Fig. 8. Hierarchy of needs for animals adapted from Maslow’s hierarchy. (From Mills D, Dube MB, Zulch H. How animals respond to change. In: *Stress and Pheromonotherapy in Small Animal Clinical Behaviour*. Chichester, UK: John Wiley and Sons Ltd.; 2013:3-36; with permission.)

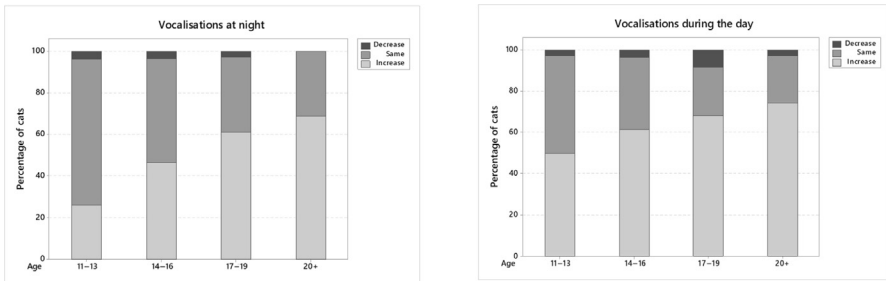


Fig. 9. Changes in vocalization in elderly cats—as per their owners.

Box 5

Common diseases of elderly cats

- Dental disease
 - 68% of cats greater than 3 years, increasing with age⁵⁹
- OA
 - 61% in cats of 6 years of age or older; increasing with age²³
- CKD
 - Varies from 28% in cats greater than 12 years²⁰ up to 81% in cats aged 15 to 20 years⁶⁰
 - CKD and OA often occur together⁶⁰
- CDS
 - 36% of 7- to 11-year-old cats, increasing to 88% in cats aged 16 to 19 years⁶¹
 - 28% of cats aged 11 to 14 years, increasing to more than 50% for cats 15 years of age or older³⁵
- Systemic hypertension
 - 13% of apparently healthy cats greater than 9 years of age⁵²
 - Less than 25%⁵⁰ to 65%⁵¹ with CKD
 - 10% to 90% with hyperthyroidism⁴⁸
- Hyperthyroidism
 - Varies in different countries and increases with age, for example, 12% of cats 8 years of age or older in Southern Germany⁶²; 2% cats of all-age cats in Europe and North America⁶³
- DM
 - Increasing over the past 10 years or more to 2014: 11.6 cases per 10,000 cat years at risk⁶⁴, approximately 1 in 200 cats, in males, with age, with inactivity, certain lineages of Burmese (Australia, UK), Norwegian Forest cats, Russian Blue, and Abyssinian cats in particular^{64,65}
- Gastrointestinal disease
 - Especially low-grade alimentary lymphoma, increased over the past more than 10 years; now the most common gastrointestinal cancer in cats; 60% to 75% of gastrointestinal lymphoma³¹
- Urinary tract infections
 - Common in older cats, especially with CKD, hyperthyroidism, and DM¹⁹
- Neoplasia—increasingly common in older cats
- Decline of special senses—increasingly common in older cats

Data from Refs. ^{19,20,23,31,35,48,52,59–61,63–65}

Box 6**Causes of altered behavior and increased vocalization (See also Stelow, Behavior as an Illness Indicator)**

- A. Medical differentials for common behavioral changes in elderly cats
- Hypertension
 - Degenerative disease
 - Neoplasia
 - Infection
 - Metabolic
 - Pain or inflammation
- B. Social, environmental, and emotional differentials for common behavioral changes in elderly cats
- *Attention-seeking* or resource-seeking behavior
 - *Acute frustration* owing to inability to access desired resources
 - *Chronic frustration* owing to inability to perform species-specific behaviors
 - *Socioenvironmental stress*—change in environment, diet, or owner routine; intercat conflict; traumatic event; owner conflict
 - *Generalized anxiety*
 - *Separation related problem*
 - *Sound sensitivity*
 - *Grief* owing to loss of bonded cat, dog or human

reporting it as the most common disease in their cats. Environmental modifications help cats cope with OA (see **Box 2**, Monteiro, Feline Chronic Pain and Osteoarthritis).

Management changes include having to groom cats that can no longer groom themselves (especially over the hips, where it is most painful and/or difficult to reach) (see **Box 2, Fig. 6**). Grooming decrease with age (**Fig. 7**), whereas house soiling increases,

Table 1
Mobility and dementia questionnaire

My Cat	Yes	Maybe	No
Is less willing to jump up or down			
Will only jump up or down from lower heights			
Walks stiffly			
Is less agile			
Is lame or limping			
Has difficulty with the cat flap			
Has difficulty with the stairs			
Cries when lifted			
Has accidents outside the litter tray			
Is grooming less			
Is reluctant to interact			
Plays less			
Sleeps more/is less active			
Cries loudly for no apparent reason			
Appears forgetful			

Adapted from Gunn-Moore DA. Cognitive Dysfunction in Cats: Clinical Assessment and Management. *Top Companion Anim Med* 2011; 26: 17–24; with permission.

Box 7**Behavioral changes in cats with CDS**

Cats with CDS display behavioral changes that are summarized by the acronym VISHDAAL:

- Increased Vocalizations, especially at night (see [Video 2](#))
- Altered social Interactions and relationships, either with owners or other pets for example, attention seeking, or aggressive behavior toward other animals
- Altered Sleep/wake patterns
- House soiling
- Spatial Disorientation or confusion, for example, forgetting the location of the litterbox
- Temporal Disorientation, for example, forgetting they have been fed
- Altered Activity for example, aimless wandering, or decreased activity
- Anxiety
- Learning and memory for example, forgetting the location of the litterbox, or that they have been fed

as reported in the study discussed elsewhere in this article. Although house soiling can be associated with many conditions (such as cognitive dysfunction syndrome [CDS] or behavioral problems) OA plays a pivotal role as affected cats find it painful to climb into the litterbox or out through the cat flap, and to posture to defaecate.

Exercise

Many factors may reduce older cats' willingness or ability to exercise, including muscle weakness associated with sarcopenia or ill health, OA, dehydration, and insecurity. Cats also alter their activity budget (time spent engaging in different behaviors) as they age. Feeding many small, frequent meals with or without feeding puzzles encourages exercise and improves hydration.²⁴ Lightweight toys help to facilitate play (see [Box 2](#)).

PROMOTING EMOTIONAL WELL-BEING IN ELDERLY CATS

Veterinary medicine tends to focus on physical well-being; however, the emotional well-being of our patients is just as vital owing to the interplay between emotional distress, behavior problems, and disease (C.A. Tony Buffington and Melissa Bain's article, "[Stress and Feline Health](#)," in this issue). A stressor is a physical or socio-environmental stimulus that triggers an acute or chronic physiologic and/or behavioral stress response within an individual. A state of emotional distress occurs when the

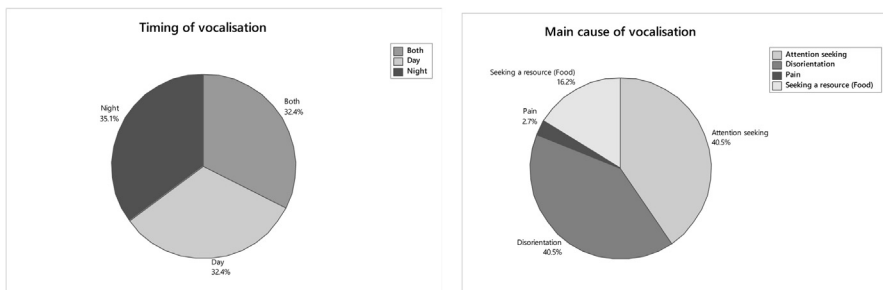


Fig. 10. Increased vocalization in cats with cognitive dysfunction—time of crying and the client speculated reason for the crying.



Fig. 11. BP evaluation; the cat is relaxed in its bed, and the student is using headphones so noise does not upset it.

animal is unable to adapt to cope with the cumulative impact of the stressors to which it is exposed. The burden of allostasis (adapting to everyday stressors) is the “allostatic load”; this load increases with advancing age, so elderly animals are less resilient and more susceptible to emotional distress.²⁵ Many other variables also play an important role in how an animal copes with stress, including genetics and early life experience.

Motivational Theory

Mills and colleagues²⁶ (2012) modified Maslow’s hierarchy of needs (**Fig. 8**) to help explain how animals prioritize their needs to achieve psychological well-being. The motivation to attain physiologic well-being has the highest priority, with security (of self and important resources) and social stability following. Only once these needs have been addressed can the animal devote energy to emotional resilience and the desire to explore and seek information about their environment is reinstated.

Specific needs of individual cats may change over time, being influenced by different factors such as temperament, breed, early life experience, health status, and changes within the home environment, as well as age.²⁷ **Box 2** explores some of the social and environmental changes that may be required to optimize psychological well-being in the elderly cat, with a focus on creating a secure and accessible core



Fig. 12. Consider elbow OA when assessing BP—do not straighten the limb, hold it at a relaxed angle; place the cuff below the elbow in line with the heart.

Box 8**What changes owners should look for as potential signs of ill-health in their mature cat
Food and water consumption**

- *Body weight and shape*, for example, loss of weight and/or muscle mass, changing body shape (muscle loss along the back and hips, while the abdomen becomes more obvious)
- *Production of urine*, for example, size of urine ball in litter box (Fig. 28) and feces (eg, diarrhea or, more commonly in older cats, constipation, and/or house soiling)
- *Behavior*, for example, increased vocalization, confusion, twitching (potential focal seizures), increased hiding, and so on (see Figs. 7 and 9)
- *Mobility*, for example, OA affecting the elbows, carpi, hips, stifles, hocks and tarsi, and may even affect the spine, from the neck to the tail
- The *Mobility and Dementia questionnaire* can be very helpful in indication that these problems are present (see Table 1).
- *Ask owners to video any behaviors of concern*, for example, locomotion, coughing, altered breathing, regurgitation/vomiting (plus anything the cat brings up), constipation/diarrhea (and what is produced), crying, confusion, and so on, because these can be revealing. Pictures of cats sitting or sleeping in unusual positions can also be helpful (see Fig. 6).
- It can be difficult to differentiate behavioral changes caused by behavioral or neurologic diseases from CDS or OA in elderly cats; it is not unusual for an individual cat to have multiple conditions.

Box 9**Minimizing stress associated with visiting the veterinary clinic**

- Acclimatize the cat to its carrier from an early age, and with each new carrier. Where possible, leave the carrier out with a soft bed in it, feed the cat treats in it. *It needs to feel a normal and safe place.*
- Clean it out fully after each clinic visit to ensure negative pheromones do not linger
- Place an old favored jumper in the carrier (owners scent is usually calming) and/or spray Feliway Classic into it approximately 15 minutes before placing the cat in it to help calm the cat.⁶⁶
- Acclimatize the cat to car travel so travel does not cause stress.
- If cats become very stressed, either by the cat carrier, the journey, or the clinic visit, give gabapentin⁶⁷ or trazadone⁶⁸ 50 to 100 mg per cat by mouth or mixed in a little food approximately 90 minutes before travel. These strategies usually result in a much calmer cat, with no negative effects on BP, heart rate, and so on.
- A calmer cat results in a calmer owner, who is more likely to listen to the vet and do as advised, they are also more likely to bring the cat back to the clinic when needed.
- Owners of multiple cats should consider keeping a cat that has just returned from a clinic visit separate (with access to key resources) for a short period of time because the disrupted scent profile of the returning cat can sometimes result in social conflict. Diffuse Feliway Friends and/or use a cloth to gather scent of other cats from the same social group to rub on the returning cat to facilitate reintroduction to the household.

Box 10**Why owners of elderly cats are often reluctant to visit their veterinarian**

- The belief that the change is part of normal aging, for example, loss of weight or muscle mass, OA, blindness, deafness, confusion/CDS
- Embarrassment that they cannot cope with their cat's behavioral changes, for example, increased vocalization and/or house soiling
- The misconception that nothing can be done to help their cat
- The stress to owner and cat associated with a trip to the veterinary clinic
- Worries that euthanasia will be suggested

territory. These changes may be necessary to support cats suffering from specific health problems or, more generally, to decrease socioenvironmental stress.

WHAT HAPPENS WHEN EMOTIONAL WELL-BEING IS COMPROMISED?

Sustained compromise to the physiologic and/or emotional well-being of an elderly cat increases its allostatic load, further decreasing its ability to cope with socioenvironmental stress, resulting in some degree of emotional distress. This stress can manifest in a range of medical as well as behavioral problems, with a great deal of overlap between the 2 (C.A. Tony Buffington and Melissa Bain's article, "[Stress and Feline Health](#)," in this issue). Terry Marie Curtis' article, "[Behavior Problem or Problem Behavior?](#)," in this issue. Elizabeth Stelow's article, "[Behavior as an Illness Indicator](#)," in this issue. Stress has been shown to accelerate the rate of cognitive decline in humans with early signs of dementia²⁸ and it seems logical that a similar deterioration may also be seen in cats suffering from CDS.

COMMON BEHAVIORAL PRESENTATIONS OF ELDERLY CATS

Behaviors deemed by the owner to be problematic may be adaptive (eg, urine marking or spraying within the home) or maladaptive (eg, self-mutilation or pica). The true incidence of behavior problems in cats is difficult to quantify, because only those behaviors that represent a problem to the owner (Terry Marie Curtis' article, "[Behavior Problem or Problem Behavior?](#)," in this issue.) are presented to professionals.²⁹

Owner-reported observations of the behavior of 883 cats aged 11 years and older in the UK included increased vocalization (59%; at night 44%; [Fig. 9](#)); house soiling

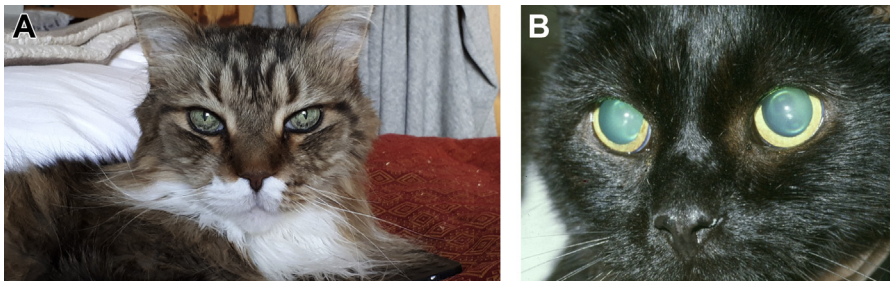


Fig. 13. Ocular changes in cats. (A) Iris atrophy. (B) Lenticular sclerosis A.



Fig. 14. Elderly cat with OA of the elbows and carpi, resulting in the feet being turned out.

(56%), often despite having a litterbox (in 83% of homes); going outside less (59%); and grooming less (36%). These changes all progressed with age (see [Fig. 7](#)). Other behaviors present in older cats that did not progress included increased sociability and affection with people (36%), increased agitation (74%), and decreased sociability with cohabiting animals (19%; see [Fig. 7](#)). They slept more (71%), drank more (44%), and ate less (24%). Of particular note is increased vocalization and sociability and affection with people.



Fig. 15. A group of cats will comfortably groom each other and sleep together.



Fig. 16. Elderly cat being fed separately so it is not stressed by its companion—this 18-year-old can still jump to the shelf.

Understanding Behavioral Changes

The reasons for increased affection, sociability, and attention seeking may include an increased dependence on the owner to provide resources, mental stimulation, and social support. Access to resources may be compromised owing to decreased mobility, loss of sensory function, and/or changes to priority of access within a multicat household owing to altered social dynamics. An increased need for social support may also result from changes in relationships with conspecifics or even the loss of a conspecific. Reasons for decreased tolerance to other animals are also likely to be related to concurrent health problems, with pain being a common reason for changes in social interactions³⁰ within a household.

In the aforementioned study, owners reported that 59% of cats went outdoors less than when they were younger, with cats aged 20 years or older no longer going outside. The reasons for this are likely to be multifactorial, including decreased mobility, pain, decreased sensory function, fear of neighboring cats, and natural changes to activity budgets. Indeed, 71% of aged cats slept more than before, and less than one-third of cats who previously enjoyed hunting still did so.



Fig. 17. Elderly with dementia having additional meals from a timed feeder.

COMMON DISEASES OF ELDERLY CATS

Etiologies

Elderly cats may suffer from many diseases (**Box 5**). The most common chronic conditions reported by owners were OA (36%), dental disease (31%), CKD (23%), hyperthyroidism (14%), and deafness (13%) (see **Fig. 5**). Interestingly, some disorders typically considered by veterinarians as common in elderly cats, for example, gastrointestinal disease (inflammatory bowel disease and low-grade alimentary lymphoma)³¹ were rarely reported, whereas disorders that veterinarians might not consider, occurred commonly (apparent deafness).

Diagnosis and Management

Diagnosis and management of illness in elderly cats is often complicated. Concurrent diseases can present with similar clinical signs, for example, OA, polyuria (caused by CKD, DM, and/or hyperthyroidism), fecal urgency (caused by chronic gastrointestinal disease), and/or constipation, can all present as house soiling. Concurrent hyperthyroidism and DM can be confusing because their clinical signs are similar, and they complicate each other's diagnosis: unstable DM decreases serum thyroxin concentrations (via euthyroid sick syndrome)³² and hyperthyroidism decreases serum fructosamine concentrations via increased protein turnover.³³ Treatment of 1 disease may also worsen another; for example, treatment of hyperthyroidism can unmask CKD.³⁴ A complete investigation is therefore essential if management is to be most effective.

DISEASES THAT CAUSE ALTERED BEHAVIOR AND APPARENT SENILITY

Behavior changes (eg, increased vocalization; **Video 2** night crying) and apparent senility are seen frequently in older cats,³⁵ resulting from many different disorders



Fig. 18. Elderly cat with severe elbow OA eating from raised food bowls.



Fig. 19. Elderly cat using a water fountain. (Courtesy of S. Miele, Edinburgh, UK.)



Fig. 20. (A, B) Elderly cats with steps to his preferred sleeping place. (B) Cats with severe OA may prefer round steps be replaced by flat ones. (Courtesy of P. Purves, Walkerburn, UK.)



Fig. 21. (A) A good litter box for elderly cats, large and high sided, except for the entrance. (B) A tray makes a shallow litter box for a cat with severe OA.

(**Box 6**; Elizabeth Stelow’s article, “[Behavior as an Illness Indicator](#),” in this issue). Of particular importance are CDS, systemic hypertension, and OA (Monteiro, Feline Chronic Pain and Osteoarthritis). Socioenvironmental stress, frustration, or anxiety are other important differentials.

Differentiating between physical and cognitive maladies requires a thorough history to evaluate social and environmental factors, completing a Mobility and Dementia Questionnaire (**Table 1**), and a full investigation looking for underlying illness.

Cognitive Dysfunction Syndrome

CDS and dementia are an age-related deterioration of cognitive abilities, characterized by behavioral changes (**Box 7**) that cannot be attributed to another condition. Antemortem, this is a diagnosis of exclusion, achieved after systemic illness, pain, and other behavioral disorders have been excluded, and environmental issues have



Fig. 22. Cat-proof garden with steps to a covered walkway.



Fig. 23. Elderly cat with a horizontal scratching box playing with the ball inside its base.

been addressed. One study found that 28% of 154 pet cats aged 11 to 14 years develop at least 1 elderly-onset behavior problem, increasing to more than 50% for cats of 15 years of age and older.³⁵

Behavioral changes and clinical signs

The behavioral changes comprising CDS are summarized by the acronym VISHDAAL (see **Box 7**). The prevalence of increased vocalization was discussed previously (see **Fig. 9**). Unpublished (Cerna P et al, 2020) data on 37 cats with CDS found that most cried at night (67%); the owners believed the main cause to be disorientation (41%), attention and affection seeking (41%), and looking for food (16%; **Fig. 10**); 67% of the cats had become more affectionate.

Because owners often misinterpret these changes as “normal” aging, especially if they are subtle, veterinarians must ask specific questions (see **Table 1**).

Pathophysiology

Although the pathophysiology remains under investigation, it is believed that oxidative damage, vascular changes (including infarcts and microhemorrhages) and changes in cerebral blood flow (eg, from hypertension, heart disease) play a role in the development and progression of CDS.³⁶

Management

There is no licensed treatment for CDS in cats; however, appropriate management can ameliorate clinical signs and improve quality of life. Reassurance and cuddles,



Fig. 24. Elderly cat on a lead with his owner so he feels more confident.



Fig. 25. (A, B) Elderly cat using a designated lap cover.

environmental enrichment, dietary supplements, specific diets, and drug treatments may all help; if these fail, owners can use ear plugs.

Dietary supplements Dogs with CDS given S-adenosyl-L-methionine (SAME) showed evidence of improved awareness and activity levels.³⁷ Both dogs and cats performed better on cognitive tests (reversal learning and object discrimination), with improvement in cats being more evident in the least impaired individuals.³⁸ SAME may be beneficial in the early stages of disease.³⁹

A study using a supplement containing phosphatidylserine, omega 3 fatty acids, L-carnitine, co-enzyme Q10, selenium, vitamins E and C, plus alpha lipoic acid (Aktivaite, VetPlus) resulted in improved social interactions, house soiling, and disorientation in dogs.⁴⁰ Because alpha-lipoic acid is toxic in cats, a feline version has been commercially released, but has not been tested for safety or efficacy.

A different supplement, containing phosphatidylserine, pyridoxine, ginkgo biloba extract, resveratrol and d-alpha-tocopherol (Senilife; CEVA Animal Health, Lenexa, KS) improved memory and reduced signs of CDS in dogs.⁴¹ Although this supplement is labeled for use in cats, no trials have been performed to determine its safety or efficacy in this species.

Specific diets Commercial diets supplemented with essential fatty acids and antioxidants increased activity level,⁴² longevity,⁶ and improve brain function in cats.⁴³

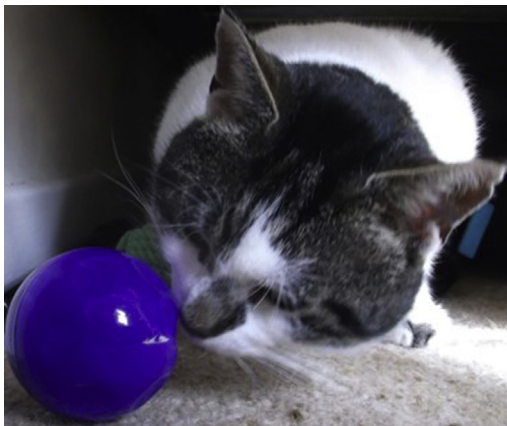


Fig. 26. Puzzles feeders provide mental stimulation and increase exercise. (Courtesy of H. Titmarsh, Midlothian, UK.)



Fig. 27. Elderly cat with lightweight toy.

Environmental enrichment Environmental enrichment provides mental stimulation that can lead to improved cognition (in dogs).⁴⁴ To decrease the risk of developing CDS, environmental enrichment should be provided to young cats, especially if they have no outside access (see **Box 2**). In contrast, elderly cats with CDS cannot cope with changes in their environment or routine, causing confusion, increasing stress, and worsening clinical signs.⁴⁵ To minimize this negative effect, decrease the size of their environment, ensuring that all key resources are easy to access.

Drug treatments

Although drugs for the treatment of CDS, such as selegiline and propentofylline, have only been studied in dogs,⁴⁶ efficacy in cats has been anecdotally reported. Other drugs can be used to decrease specific clinical signs of CDS in cats. Antidepressants and anxiolytics (eg, gabapentin, fluoxetine, trazadone, buspirone), as well as complementary remedies (eg, melatonin, plug-in pheromones, essential oils [although some are toxic to cats]) may help to decrease anxiety and improve sleeping patterns.⁴⁷



Fig. 28. Urine volume can be assessed by the diameter of the ‘litter ball’ in clumping litter.

Systemic Hypertension

Clinical signs

Infarcts or aneurisms induced by hypertension (see Rebecca F. Geddes’ article, “[Hypertension: why it is critical?](#),” in this issue.) can cause cerebrovascular accidents resulting in behavioral changes and neurologic disease in elderly cats.⁴⁸ Hypertension can also cause target organ damage to the eyes, heart, and kidneys, resulting in intra-ocular hemorrhage and/or hypertensive retinopathy, congestive heart failure and exacerbation of CKD.⁴⁸

Pathophysiology of hypertension

Hypertension is most commonly secondary to CKD and hyperthyroidism. Prevalence in CKD varies from general practice (<25%)⁴⁹ to referral hospital (65%).⁵⁰ Prevalence with hyperthyroidism (10%–90%)⁴⁸ likely reflects the reactive nature of cats. Situational hypertension (white coat hypertension) can increase blood pressure (BP) by 75 mm Hg,⁵¹ so persistent elevation is needed before diagnosing hypertension. Other diseases or drugs can, less commonly, cause hypertension, including hyperaldosteronism, DM, acromegaly, hyperadrenocorticism, and erythropoietin therapy.⁴⁸

Elderly cats are predisposed to hypertension (because of diseases like CKD and hyperthyroidism); additionally, 13% of apparently healthy cats aged more than 9 years are hypertensive.⁵² However, normal BP also increases slightly with age (approximately 1–2 mm Hg per year), making diagnosis confusing.⁵³

Unfortunately, hypertension is often only suspected once target organ damage has occurred; that is, cerebral vascular accidents (behavioral changes or seizures), intra-ocular hemorrhage or blindness, CKD, and/or heart failure.

Treatment

Antihypertensive drugs (amlodipine or telmisartan) should be prescribed as per the American College of Veterinary Internal Medicine Guidelines (Figs. 11 and 12)⁴⁸; a systolic BP of less than 140 mm Hg is considered to carry a minimal risk of target organ damage, 140 to 159 mm Hg [low risk], 160 to 180 mm Hg [moderate risk], and greater than 180 mm Hg [high risk], taking clinic-specific stress factors into consideration before deciding whether or not to treat for hypertension and before substaging patients with CKD.

THE VETERINARY PRACTICE AS A PRIMARY SOURCE OF ADVICE ON AGING

Midlife Clinic Visits

Potential aging changes and geriatric diseases should be discussed with owners of mature cats at routine examinations and vaccination appointments. It is not always

easy for owners to recognize the signs of ill health in their cat, so vets must educate them as to what should be monitored (**Box 8**) and explain that changes are not always “normal,” and they may result from treatable disease (see **Box 1**). These visits also provide opportunity to discuss minimizing stress associated with clinic visits (**Box 9**), and how best to maintain their aging cats’ physical and emotional well-being (see **Box 2**).

Senior Health Care Clinics and Client Education Evenings

Senior health care programs should be offered to all clients with cats greater than 8 years of age. Initially, most cats need only attend 1 to 2 times a year, unless they already have significant disease.⁵⁴ Ideally, nurse-led clinics can be alternated with vet-led ones.⁵⁵ These provide an opportunity to monitor the cat’s weight, percentage weight change, and BP, to collect information on eating and drinking, and for the cat’s physical and emotional well-being to be assessed. Owners of elderly cats are often reluctant to enlist the help of veterinarians when they notice a change in their cat’s physical or mental health. Veterinarians and nurses need to be aware of these concerns (**Box 10**), and specifically ask about them during elderly cat consultations. Client education evenings are another good way to increase client awareness of low stress handling, common conditions of old age and treatment options.

Ultimately, these interventions increase the likelihood of clients identifying early signs of ill health in their cat (physical or emotional) and they embrace the veterinary clinic as their primary source of information and support, resulting in an increased quality of life for cats and their owners.

Treat the Individual

Although veterinary medicine can offer complex diagnostic and therapeutic options, it is important to remember that elderly cats are often poorly tolerant of physical handling, or the stress of hospitalization. Each cat must be assessed and treated as an individual. Occasionally, investigations or interventions may have to be adapted or even abandoned if they are poorly tolerated for either medical or temperamental reasons. Although old age is not a disease, it is important that we pay particular attention to our older cats, care for them appropriately, and observe them closely so we can keep them well, for as long as possible.

DISCLOSURE

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.cvsm.2020.03.004>.

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