

Abnormal Repetitive Behaviors in Dogs and Cats: A Guide for Practitioners

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KEYWORDS

- Repetitive behaviors • OCD • Obsessions • Compulsive disorders • Stereotypies
- Frustration • Conflict • Self-injurious

KEY POINTS

- Stereotypies and compulsive/impulsive disorders represent 2 different forms of repetitive behaviors. Although they share similarities and possibly overlapping neurophysiology, they are not the same thing.
- Stereotypy and compulsive disorder (CD) are not diagnoses to be made carelessly; too little is currently known about their underlying pathophysiology, and no clear diagnostic criteria exist.
- Many medical conditions can result in or contribute to repetitive disorders, so treatment of concurrent or underlying conditions are a critical part of the overall treatment plan.
- Abnormal repetitive behaviors (ARBs) that are not caused by medical conditions, pain, paresthesia, or dysesthesia are likely a result of anxiety due to feelings of conflict or frustration.
- Complete resolution of an ARB is uncommon, but a variety of treatments, both pharmacologic and nonpharmacologic, may be used to decrease the frequency of the behavior and thus improve the quality of life for the patient.

INTRODUCTION

The ARBs represent a highly heterogeneous group of behaviors the neurobiology of which is poorly understood. These behaviors have been observed in a large variety of captive wild and domestic species, are commonly associated with certain husbandry practices, and are generally believed to be reflective of poor welfare. The ARBs have historically been referred to as stereotypies, obsessive-compulsive disorders (OCDs), and compulsive disorders (CDs) by various investigators. Although the veterinary literature regularly uses the term stereotypies and obsessive-compulsive or compulsive disorders interchangeably, evidence continues to grow that these are 2 distinctly different, yet complexly related, behaviors, about which there is much to

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learn. Prematurely attempting to assign these different labels to companion animal behavior problems may have led to confusion in our thinking.¹ In addition, the careless application of labels may prevent prompt and appropriate treatment of animals afflicted with these behaviors. **Box 1** lists some useful definitions of the current terminology. For the purpose of this article, the term abnormal repetitive behaviors is used to include all the aforementioned behaviors. Although the use of the term abnormal

Box 1

Some useful definitions

Perseveration

The inappropriate repetition of behaviors elicited in an experimental or diagnostic context. There are 3 recognized forms of perseveration, and they each reflect brain dysfunction at a different level of executive processing.

Stereotypic behaviors

A descriptive term referring to any behavior that is repetitive or stereotypic in form and whose mechanism is either not known or not of concern. Some stereotypic behaviors are normal, such as grooming sequences or ritualized courtship behaviors.

Stereotypies

The repetitive, unvarying behavior patterns with no apparent goal or function, commonly displayed by captive animals.¹⁵

Frustration

Occurs when an individual is motivated to perform particular behavior but is somehow prevented from doing so.

Conflict

Occurs when an individual is motivated to perform 2 opposing behaviors at the same time.

Displacement behaviors

Normal behaviors shown at an inappropriate time or out of context for the situation. Grooming behaviors are commonly seen as displacement behaviors in a variety of species.

Redirected Behaviors

Behaviors that are redirected away from the target stimulus and toward a different target that did not trigger the original behavior. Many animals redirect aggression toward a more convenient target when they are prevented from reaching the target that triggered their aggressive response.

Vacuum activities

The performance of a behavior in the absence of the normal substrate required for the performance of the behavior. One example is vacuum chewing in sows, where they perform the motor patterns associated with chewing in the absence of any food.

Obsessive-compulsive disorders

OCDs are characterized by obsessions, recurrent thoughts, urges or images, and compulsions, the repetitive mental acts or behaviors that an individual feels driven to perform in response to the obsessions.

Obsessive-compulsive spectrum disorders

This term is used to cover conditions that are included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, under OCDs but recognized to have important differences and similarities. Examples include conditions such as trichotillomania and pathologic gambling, conditions that are also often referred to as impulse control disorders.

could be debated, in the context of this article it is used to signify the likely maladaptive nature of these behaviors, as well as the possibility that they may represent an underlying pathologic condition. Whether that pathologic condition is a result of an inappropriate environment or something inherent in the affected individual (or more likely a complex interaction between the two) is also yet to be determined.

Many have posited that anxiety, associated with conflict, frustration, or other stressors, contributes to the development of repetitive behaviors. In addition, a genetic predisposition has been well documented in several species^{2,3} and in certain dog and cat breeds,⁴⁻⁷ and autoimmune mechanisms have been identified in the development of some forms of OCD in humans.^{8,9} Different neurotransmitter systems have also been implicated in these problems and have included the opioid-mediated, dopaminergic, serotonergic, and glutamatergic systems. Continuing to recognize and attempting to differentiate between the differing forms of ARBs are critical to better understand them and improve the ability to treat them successfully or even prevent them.

NATURE OF THE PROBLEM

ARBs are often looked upon by pet owners as a source of amusement¹⁰ and thus are not always presenting complaints to the veterinarian. In many cases, the pet owner does not perceive the behavior as a problem until it either results in self-harm or the animal spends an inordinate amount of time performing the behavior, thus interfering with their ability to function optimally in the environment with the pet owner or other pets.

Repetitive behaviors documented in dogs and cats have included spinning and tail chasing, hind end checking, staring, light and shadow chasing, fly snapping, wool sucking, flank and blanket sucking, and even some self-injurious behavior (SIB), such as acral lick dermatitis (ALD). Such enormous variation exists between these different behaviors, as well as in the same behavior in different individuals, that at this time, one cannot even state that all these conditions are indeed homologous or share similar neurophysiologic underpinnings. To further complicate matters, as diagnostic capabilities continue to improve, new evidence is arising that suggests that many of these problems may arise from underlying medical conditions.^{11,12}

Although stereotypic behavior may be a component of obsessive-compulsive behaviors, the 2 terms are not interchangeable. Within psychiatry, a diagnosis of OCD is distinct from a diagnosis of stereotypy and other body-focused repetitive disorders such as trichotillomania. These conditions are all recognized to be related and possibly overlapping but may result from completely different underlying mechanisms. Some investigators suggest that the term stereotypy should be restricted to a specific subset of stereotypic behaviors, those manifested by recurrent or continuous perseveration associated with basal ganglia dysfunction.¹³ Stereotypies in humans are seen most often in a range of neurodevelopmental syndromes or disorders, such as certain forms of mental retardation or autism. Similar to animals, these patients are often nonverbal and therefore their stereotypies are defined based entirely on behavioral signs, which is in contrast to OCDs in humans whereby the patient's cognitive experiences are a requisite part of the definition of the behavior.¹⁴

STEREOTYPIES

The stereotypic behaviors of farm animals and captive wild animals have been recognized and studied for more than 50 years. The most fascinating feature of these behaviors is the diverse array of stereotypies shown by different species and even the variations seen within species. Common stereotypic behaviors in rodents include

bar chewing, jumping, back flipping, digging, and circling. Stereotypic behaviors seen in ungulates are more likely to be oral in form and include crib biting in horses, sham chewing in sows, and tongue rolling in cattle and giraffe. Captive carnivores typically perform locomotor stereotypies such as pacing, circling, or weaving. This clear distribution of different forms of stereotypic behaviors among different taxons is striking and should raise the question, is a pacing bear suffering from the same condition as a back flipping mouse or a tail chasing Bull Terrier?

The variation among these different types of behavior has actually made it challenging to even answer the question, “What is a stereotypy?”, but most agree that a stereotypy is a behavior performed in an invariant and repetitive manner, which has no apparent function. (Box 2 lists features shared by all stereotypies.) However, these repetitive behaviors are not seen in animals in the wild, leading to the theory that stereotypies are caused by developing and/or living in an environment that is barren or somehow inappropriate. Efforts to enrich environments as a treatment of stereotypic behaviors succeed in some cases but fail to completely resolve the problem in many. In addition, the question that remains is, Why do some animals in a particular environment develop stereotypies, whereas others of the same species in the same environment do not?

A variety of different factors have been suggested as the basis for stereotypy development, including a heightened sensitivity to stress, a general disinhibition of behavioral control mechanisms, or a lack of opportunity to perform a normal array of species-typical behaviors.¹⁵ The result is that animals repeat the same behavior patterns to the point that other behaviors are performed less often, and the one behavior pattern, the stereotypy, is repeated, to the detriment of other behaviors. With repetition, behaviors become less variable.

It has also been proposed that the brain contains a set of executive systems that filter, integrate, and translate stimuli into expressed behavior. Disruptions to this system have been shown to interfere with an individual’s ability to shift tasks or motor patterns, resulting in perseveration or an inappropriate repetition of behaviors.¹⁷ The possibility that stereotypies reflect acquired brain pathology due to poor housing conditions has yet to be determined. It is also possible that normal individual variation in brain function results in the tendency to perform stereotypies.

Possible Functions of Stereotypies

Although it may seem strange to attempt to understand the function of something that is defined as being functionless, the definition of stereotypies as being functionless is simply an indication of how little is known about these behaviors.¹⁶

Box 2

Features of stereotypies

- They develop from motor patterns typical for the species, which have been referred to as source behaviors.¹⁵
- Most agree that one feature common to all situations in which stereotypies develop is the presence of frustration.¹⁶
- They develop slowly, becoming more fixed and invariant with repetition.
- Eventually, stereotypies continue to be performed even in the absence of the original eliciting stimulus. They are then referred to as emancipated.

- Stereotypies have been hypothesized to help animals cope with an environment that is somehow inappropriate or inadequate. This theory was based on the suggestion that repetitive behavior led to increased release of endogenous opioids and that stereotyping animals were self-narcotizing.¹⁵
- The coping hypothesis was at first partially supported by the fact that stereotypies were often stopped by administering narcotic antagonists.¹⁵
- However, when treated successfully with narcotic antagonists, stereotypies were usually stopped immediately. This result is inconsistent with the theory that the behavior is intrinsically rewarding. If that were the case, the behaviors would be more likely to increase before stopping (an extinction burst).
- Overall, there is no good evidence that all stereotypies help animals to cope, although some may have beneficial effects. Whether coping effects cause stereotypies or are simply beneficial side effects remains to be elucidated.¹⁶

Another more popular theory behind the development of stereotypies is that they are reflective of the thwarting of highly motivated behaviors.¹⁶ Although most captive animals' needs for food, water, and shelter are met (consummatory needs), the species-typical behaviors normally associated with the acquisition of those needs (appetitive needs) are not, in most cases. This situation may leave these animals in a highly motivated state to perform particular motor behaviors for which hundreds or thousands of years of evolution have prepared them. Thus, the pacing of carnivores may represent the appetitive search phase of the hunt¹⁸ and the cribbing of horses the unfulfilled feeding motivation that results when eating high-concentrate, low-fiber diets.¹⁹ The possibility that certain stereotypic behaviors of dogs (such as light chasing by herding breeds) may represent the frustrated drive to perform behaviors for which they have been bred, but too often are unable to perform in the typical pet household, needs to be explored.

Neurobiology of Stereotypies

Psychomotor stimulant drugs, such as amphetamines and apomorphine, can induce stereotypies, it is thought, by their activation of the dopaminergic systems in the basal ganglia. Increasing doses of these drugs leads to increased rigidity and intensity of the behaviors.²⁰ Captive animals experiencing high levels of stress also experience massive release of endogenous opioids that modulate dopaminergic pathways. It has been hypothesized that rather than simply having an affect due to their rewarding properties, these opioids are sensitizing the dopaminergic pathways in the basal ganglia.²¹

OBSESSIVE-COMPULSIVE DISORDERS

OCDs have been well documented in people, yet many questions remain unanswered about their cause, development, and treatment. OCD in humans is a severe, disabling, chronic condition that affects 2% to 3% of the US population.²² People with OCD experience intrusive and unwanted thoughts or images. Compulsions are the mental acts or behaviors that the person feels driven to perform to deal with the obsessions. Many patients describe that feelings of anxiety are associated with the obsessions and that the performance of the compulsive behaviors relieve these feelings of anxiety.¹⁴

OCD has been noted to develop in one subset of the population early, before puberty, and in another subset, later in adulthood, leading some to suggest that 2 different subtypes of OCD should be recognized because they may have different neurobiological underpinnings.²³ For example, early-onset OCD is more prevalent in

males, whereas adult-onset OCD is more prevalent in females and is more sensitive to treatment.²³ OCDs seem to be familial, but their genetics are poorly understood.

The neurobiology of OCDs has been the subject of much research in the last 20 years, and modern neuroimaging techniques have led to greater understanding of many neuropsychiatric conditions in people. OCD and the OCD spectrum disorders may best be viewed as a group of multiple overlapping syndromes rather than a single entity. It is currently proposed that abnormal metabolic activity in the orbitofrontal cortex, anterior cingulate/caudal medial prefrontal cortex, and the caudate nucleus is associated with OCD and OC spectrum disorders.²⁴ Numerous corticostratial loops are involved in the sequencing of goals, behaviors, and movements. It is generally believed that there is an indirect pathway and a direct pathway, with the indirect pathway decreasing stimulation of the thalamus and the direct pathway increasing activity of neurons in the thalamus. The direct pathway functions in the initiation and continuation of behaviors and the indirect pathway is important for the inhibition of and switching between behaviors.²⁵ These pathways are modulated by opiates, dopamine, serotonin, and several other neurotransmitters.²⁶ The complex way in which these pathways and neurotransmitters interrelate contributes to the challenge of medicating patients with OCDs and related disorders. No single neurotransmitter causes the problem, and few drugs effect only a single neurotransmitter.

OCD in people can be refractory to treatment, and medication, as well as cognitive therapy and other nonpharmacologic therapies, is often required to achieve satisfactory treatment results. Serotonin reuptake inhibitors are the first line of treatment of human OCDs, and it is serotonin's inhibitory role on dopamine that is thought to contribute to their efficacy. Dopamine plays a dual role on the balance between the direct and indirect frontal striatal pathways.²⁵ However, other drugs, such as the atypical antipsychotics, clomipramine, buspirone, and clonazepam, have also been used as augmenting agents,²⁷ because there remains a population of people who do not respond to treatment with serotonergic drugs. Deep brain stimulation has recently been shown to have beneficial effects in treating some patients with OCD.²⁸

STEREOTYPY VERSUS COMPULSIVE DISORDERS

The term stereotypy has traditionally been used as a descriptive term that gives no information about underlying neurobiology or possible pathophysiology. In fact, the stereotypies commonly seen in captive animals are so numerous and varied that it is unlikely that they are homogenous in regards to cause, development, physiology, or function.¹

OCD is a psychiatric diagnosis and a disease in humans that shares similarities between some repetitive behaviors in animals, but the research suggesting that certain repetitive behaviors in dogs or cats can serve as models for human OCDs are rife with weaknesses. The more common conditions in dogs and cats that have been referred to as CDs are covered in more detail later. **Table 1** lists some of the behaviors often labeled as CDs and the breeds thought to be more commonly affected.

An investigation into the differences and similarities between stereotypies and OCDs, using a systems approach to the problem, has led to the hypothesis that stereotypies arise from disruption of basal ganglia systems. OCDs and related impulse control disorders arise from disruptions in the prefrontal cortex and the numerous pathways between the prefrontal cortex and the rest of the brain.¹⁷ Research on humans with brain damage or dysfunction show different neurologic signs depending on which part of the brain is affected and support the concept that the difference between stereotypies and between impulsive/compulsive disorders lies in *what* is

Breed	Behavior	Reference
Dobermans	Flank sucking	6,29–33
Bull Terriers, German Shepherd dogs, Australian Cattle dogs	Tail chasing	5,29,30,32–41
Schnauzers	Hind checking	30,41
Cavalier King Charles Spaniels, Border Collies, Terriers	Light (shadow) chasing	30,33,40,42,43
Siamese cats	Fabric sucking and ingestion	40,41
Bengals	Overgrooming	40

Data from Refs. 5,6,29–43

repeated. In impulsive/compulsive disorders, an inappropriate goal is repeated (such as the plucking of hair by a person with trichotillomania), and in stereotypies, a particular motor pattern is repeated.¹⁷ Although this still does not answer the question as to whether behaviors in animals labeled as compulsive are homologous in any way to those in humans, or not, it does support the concept that stereotypies and CDs are 2 distinctly different conditions that need further study both in humans and animals in order for one to be able to use these labels in dogs and cats with any accuracy (Fig. 1).

COMPULSIVE DISORDERS IN ANIMALS

The term compulsive disorders was initially coined when certain repetitive behaviors of dogs and cats were hypothesized to be similar to OCDs in humans. It was suggested that because one could not ascertain whether or not animals obsessed it was best to refer to these as CDs.

CDs in dogs and cats have been categorized as locomotor, hallucinatory, self-injurious or self-directed, and oral.⁴⁴ Several of these categories seem to overlap,

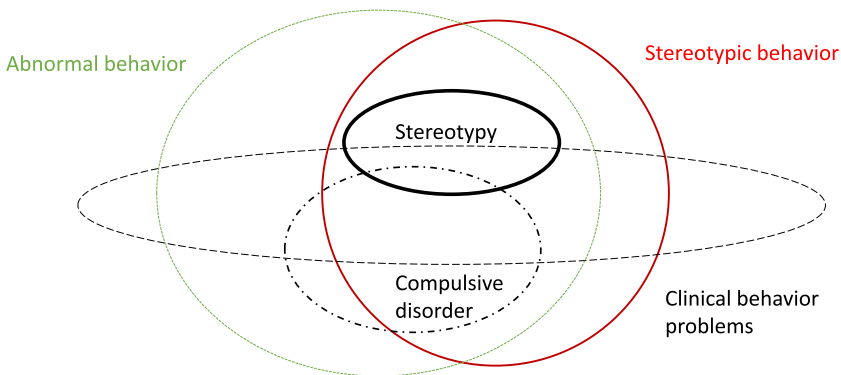


Fig. 1. Relationship between stereotypies, compulsive disorders, and stereotypic behaviors as they may occur within the range of abnormal behaviors and clinical behavior problems. (Adapted from Mills DS, Luescher AU. Veterinary and pharmacological approaches to abnormal behaviour. In: Mason G, Rushen J, editors. Stereotypic animal behaviour: fundamentals and applications to welfare. 2nd edition. Wallingford (WA): CABI; 2006. p. 293; with permission.)

and some repetitive behaviors seem to lie on a continuum between the categories. For example, tail chasing or spinning has been described as a locomotor CD, but if the tail is also attacked and mutilated, the behavior would be considered a self-injurious one. Staring at lights and shadows could seem to be a hallucinatory CD, but if the animal also chases lights and shadows, then the behavior would be considered a locomotor CD.

Oral CDs such as pica and surface licking can easily be a result of an underlying medical condition, and it is far too easy to label them as a CD simply because a medical condition was not identified. However, recent research supports the likelihood that in many cases, gastrointestinal disease leads to behaviors such as surface licking and fly snapping or air biting.^{11,12}

A working definition of CDs in animals was proposed by Hewson and Luescher⁴⁵ in 1996 and reads as follows:

“Behaviors that are usually brought on by conflict, but that are subsequently shown outside of the original context. The behaviors might share a similar pathophysiology (eg, Changes in serotonin, dopamine and beta endorphin systems). Compulsive behaviors seem abnormal because they are displayed out of context and are often repetitive, exaggerated or sustained.”

This definition is strikingly similar to the definition and features of stereotypies, so it does little to clarify attempts to diagnose and treat a repetitive behavior in a dog or cat.

Overall defines the behaviors in this way: “OCDs are characterized as behaviors that are not only stereotypic and ritualistic but those in which the urge to engage in them or the process of engaging in them severely interferes with normal functioning.”⁴⁶

This definition is similarly problematic in that many repetitive behaviors in dogs and cats that are commonly referred to as CDs are not described as interfering with the animals’ normal functioning according to their owners.⁶

Few controlled studies have been performed on CDs in dogs and cats. The studies that have examined treatment efficacy have included such a variety of different behaviors referred to as compulsive behaviors that the usefulness of the results is questionable. The studies that have examined specific repetitive behaviors in pets are discussed in more detail later.

Tail Chasing and Spinning

Tail chasing and spinning behaviors have often been reported in Bull Terriers and German Shepherds, although other breeds displaying this behavior have also been documented. Although tail chasing seems to run in families, its genetic basis is unknown. A study that included pedigree analysis of 44 tail chasing and/or spinning Bull Terriers proposed that an autosomal recessive mode of inheritance exists for the condition.⁴⁷ Tail chasing can include slow to rapid spinning in both directions and often, although not always, leads to the dog actually grasping and eventually mutilating its tail tip. Some dogs begin by focusing on their tail and then slowly begin to spin, whereas others simply spin in circles without particularly focusing on their tail.³⁹ The affect seen in tail chasing dogs can also vary greatly; some of these dogs appear frenzied and stressed, whereas others simply appear calm and focused while being completely disassociated from their environments.

Most studies of tail chasing behavior report that the median age of onset of tail chasing behavior is before sexual maturity in the dog (or at least within the first year of life), which is consistent with the development of most OCDs in humans.^{5,38} However, staring, trancelike behavior, fly snapping, and episodic aggression have also been documented in many dogs with tail chasing behavior.³⁸ Epileptiform activity

has been identified on electroencephalographs of some tail chasing Bull Terriers and combined with the other commonly seen clinical signs further supports the possibility that the behavior may represent focal seizure activity in some cases.⁴⁸ One study of tail chasing dogs found structural abnormalities in some, including hydrocephalus,⁵ but another more recent study found no abnormalities on magnetic resonance imaging (MRI) or histologic examination of a subset of the affected dogs.⁴⁷

Studies that have included observations of the dogs' temperament have found tail chasing dogs to be more active and excitable in some cases and shyer and more fearful in others,³⁹ and phobias have been found to have a high incidence of comorbidity with tail chasing behavior.³⁸ These data suggest that temperament differences may predispose some dogs to tail chasing behavior. One study reported that 31% of triggers for tail chasing involved situations that increased the dog's level of arousal or frustration.³⁸ Unpredictable or restricting environments and a lack of physical or mental stimulation made up a large percentage of the documented triggers. Only 10% of owners reported no discernible triggers for the dog's behavior.³⁸ These data lead further support to the theory that tail chasing is a displacement behavior performed by many dogs in response to conflict or frustration. However, the investigators suggest that due to the cluster of clinical signs found in the tail chasing Bull Terriers of this study, the syndrome may have features in common with autism in humans.³⁸ Attention-seeking behavior, middle ear infection, and play have all also been suggested as potential causes of tail chasing behavior, in addition to the possible diagnosis of stereotypy or CD.¹³

It is important for the clinician to keep in mind that numerous medical conditions can potentially lead to tail chasing behavior, and one documented case of tail mutilation responded to a combination of tramadol and a nonsteroidal antiinflammatory.⁴⁹ Self-mutilation is not always a component of tail chasing or spinning and in some cases may be considered a secondary problem to tail chasing. Conversely, self-mutilation is not always presented as a repetitive behavior. Anecdotally, however, pain within the tail, lower back, or around the region of the tail has been identified in cases of tail chasing, and these cases often responded to appropriate treatment of the medical conditions. In at least 2 cases, MRI and computed tomographic scans have documented lumbosacral disease in tail chasing dogs (Marsha Reich, personal communication, DVM, DACVB) that responded well to treatment with varying combinations of surgery and antiinflammatories. Because advanced imaging of this type is not within the budget of many clients, underlying medical conditions can easily be overlooked in these cases and treatment with antiinflammatories or analgesics is often indicated to rule out pain-related conditions.

Acral Lick Dermatitis

ALD or lick granuloma is a dermatologic disease that is a result of self-trauma directed at the leg. Repetitive licking of the limb eventually results in a well-circumscribed, alopecic, firm, red raised, ulcerated plaque. Lesions are seen most commonly on the cranial carpus or metatarsus, but they have also been seen, although less commonly, on the cranial radius, metatarsus, and tibia. The condition is seen more often in large breed dogs but other breeds with the condition have also been documented.^{50,51}

Lick granulomas have long been suspected of being psychogenic in origin, and some have labeled it a canine CD.^{50,51} Other behavioral causes that have been proposed include stress, anxiety, phobias, attention seeking and inadequate exercise, mental stimulation, or social interaction. However, the cause of acral lick is most likely multifactorial. A variety of causes, in addition to behavioral causes, have been

proposed. These have included pruritus due to allergies (food sensitivity or atopy), trauma, and joint disease. Research has confirmed that a variety of less common medical conditions can also result in ALD or similar-appearing lesions. These conditions include lymphoma, the presence of an orthopedic pin, deep pyoderma, and a mast cell tumor.⁵² In addition, one study found deep bacterial infection present in 95% of ALD lesions that were biopsied. To further complicate matters, this study found a poor association between bacterial isolates cultured from the surface compared with those cultured from deep tissue. More than half of the cultures were resistant to the antibiotics used most commonly to treat skin infections.⁵³ Deep bacterial infection and the ruptured hair follicles and free keratin in the dermis that occur secondary to the self-trauma are important contributing factors. These lead to intense pruritus and the perpetuation of the itch-scratch cycle.

Although grooming has been noted to be a common displacement behavior, most dogs respond to a lesion present on their skin by licking it. Dogs presented with ALD should have a thorough medical workup and a behavioral history collected. The behavioral history should be used to identify possible signs of anxiety or stress due to frustration or conflict that contribute to the licking behavior. Other anxiety-based conditions, such as noise phobias, or separation anxiety are also likely if the ALD has developed primarily because of stress or anxiety. In the authors' experience, it is highly unusual for ALD to be the only behavioral disorder in a patient. Even if other signs of behavior problems are present, ALD is not resolved without complete resolution first of the pyoderma. The lesion should be cultured if initial empiric treatment is not effective, and a biopsy of deep tissues should be included. Antibiotic therapy should be continued until at least 2 weeks after complete resolution of the lesion. Other treatment aimed at breaking the itch-scratch cycle may include symptomatic allergy medication, such as antihistamines or glucocorticoid (possibly both oral and topical). Physically preventing the dog from continuing to lick may be a critical component of the treatment, so e-collars, bandages, socks, leggings, or body suits may be tried depending on the patient. Any comorbid behavioral conditions should also be addressed separately.

Support for ALD as a model of human OCD is poor at this time. The use of clomipramine, desmipramine, fluoxetine, and naltrexone in the treatment of ALD has all been documented.^{50,51,54,55} However, most studies strictly measured licking behavior, and few clearly documented whether or not lesions were completely resolved during the trial.^{50,51,55} Some decrease in licking behavior but rarely a total cessation of licking behavior was documented. Any mention of treatment with antibiotics was also missing in some of these studies, which could be why complete healing of lesions was uncommon.^{50,51} The antihistaminic effects of drugs such as clomipramine could be responsible for the cessation of licking behavior. Finally, the average age of onset of ALD in all studies that included that information was greater than 1 year of age, which is inconsistent with the age of development of OCDs in humans.

Other Self-Injurious Behaviors

No other peer-reviewed publications have been published on SIBs in pets. However, this problem has been studied extensively in humans and nonhuman primates. In humans, SIB has been postulated to help an individual to gain control over an overwhelming emotional state, the so-called affect regulation model.⁵⁶ SIB in nonhuman primates is considered to be phenomenologically similar to SIB in humans and is believed to be a maladaptive coping mechanism. Rearing in a suboptimal environment is a common feature linking most cases of SIB in nonhuman primates, with social isolation being an important risk factor.⁵⁶ As with many ARBs, all animals reared in

inappropriate environments or in social isolation do not develop SIBs, so other yet-to-be-determined factors, such as a genetic predisposition, are likely present as well.

Nevertheless, it must also be kept in mind that self-injury has often been documented in cases in which pain, paresthesia, or dysesthesia was suspected,⁵⁶⁻⁵⁸ so a thorough physical examination and diagnostics are critical when faced with a case of SIB in a dog or cat. Empiric treatment with analgesics or antiinflammatories may be necessary before determining that SIB is occurring as a primary behavioral disorder.

Blanket and Flank Sucking in Doberman Pinschers

Blanket and flank sucking are unique repetitive behaviors that have been documented primarily in Doberman Pinschers and occur with a remarkably high frequency in North America.⁷ Because of its presence primarily in one breed, a genetic predisposition has been suspected. Recent research has identified a locus on chromosome 7 (within the CDH2 region) where the particular allele occurs significantly more often in Dobermans exhibiting these behaviors than in unaffected controls.³¹ Blanket sucking behavior involves the dog taking a blanket into its mouth and mouthing or sucking on it. Flank sucking behavior is characterized by a repetitive mouthing and sucking of the dogs own flank region. Both behaviors are a type of nonnutritive suckling and may be seen immediately before the animal falls asleep, similar to a suckling neonate. Nonnutritive suckling has been considered to be a displacement behavior performed as a result of anxiety due to conflict and thus may serve a self-comforting purpose.⁵⁹ Some have deemed blanket and flank sucking a form of CD.^{40,41}

One study examining a convenience sample of 77 Doberman Pinschers with blanket sucking, flank sucking, or both found the age of onset of blanket sucking to be significantly earlier than that for flank sucking, although the median age of development for both behaviors occurred before 1 year of age.⁶ There was no significant difference between the 2 behaviors in frequency, duration, triggers, or interruptability. Sex distribution between the 2 behaviors was similar. The most common triggers reported by owners of flank and blanket sucking dogs were inactivity and increased arousal. Owners defined inactivity as bedtime, when bored or crated, when relaxing, and so on.⁶ Examples of situations of increased arousal described by owners in this study included kenneling, separation from owners, new or uncertain situations, or loud noises. All these triggers also represent situations potentially leading to conflict or frustration, emotional states that can readily lead to anxiety and thus the expression of displacement behaviors.

In this study, only 17% of dogs with blanket sucking and 32% of dogs with flank sucking sustained any injuries or illness associated with the behavior.⁶ In addition, most owners claimed that the behaviors did not interfere with their relationship with the dog nor the dog's quality of life. Many owners provided their dog with its own blanket to suck. Because some dogs only began sucking on their flanks when a blanket or fabric was not available, this may have been considered by many owners to be the better, safer option for the dog. Although a small number of dogs that suck fabric also ingested it and developed obstructions requiring surgery, most of these dogs do not ingest fabric. The physical signs reported by some owners of flank sucking dogs included hair loss and skin lesions or ulcerations. These results are actually in contrast to at least one definition of canine CD that states the behavior should "interfere with normal daily activities and functioning."⁴⁶ Although recent research has identified brain structural abnormalities in Dobermans with blanket and flank sucking behaviors, these abnormalities are similar to those in humans with anxiety disorders but not specific to those seen in human OCD,³¹ a reminder that there is much to learn before assuming that canine

repetitive behaviors are in fact homologous to human OCDs. Because many Doberman owners do not perceive this condition as problematic, little has been documented on the actual treatment of blanket or flank sucking behavior, so there is no way to know if the condition shares face validity with human OCD.

It has been suggested that blanket and flank sucking may be a variation of pica.⁶ Pica, the persistent consumption of nonfood items,⁴ is commonly associated with a variety of medical conditions but has been considered by some to represent an oral compulsive behavior.⁴¹ It is worth noting that significantly higher number of blanket and flank sucking dogs (29% of affected dogs) in this study also exhibited pica, when compared with unaffected control dogs,⁶ suggesting that all these behaviors may lie on a continuum and pointing to the necessity of ruling out underlying medical conditions that may promote the development of these behaviors.

Wool Sucking and Pica in Cats

The oral repetitive behaviors common to cats include pica (the consumption of unusual or nonfood items) and wool sucking (also sometimes referred to as fabric chewing). However, despite its common name, many cats exhibiting this behavior target several different materials such as plastic, rubber, or leather in addition to a variety of fabrics, including cotton and synthetic.⁶⁰ No controlled studies have been performed on this condition, and as is the case with much of the literature about repetitive behaviors in dogs and cats, much of the published research did not discriminate between consuming unusual objects and simply sucking on them. This difference may prove to be critical between differing behavioral diagnoses.

Pica and wool sucking or fabric chewing has been reported to occur more commonly in Siamese cats than other breeds,⁶¹ with one study finding that Siamese cats were evaluated more frequently than expected for behavior problems related to aggression and ingestive problems such as pica.⁶² However, pica is also a sign of a diverse number of different medical conditions associated with gastrointestinal problems and nutrient imbalances. Studies have documented pica associated with pyruvate kinase deficiencies, feline infectious peritonitis, and anemia in cats.^{63–65} Damage to particular areas of the brain has been demonstrated to lead to pica,⁶⁶ once again suggesting that labeling it a CD is often premature and may put the patient at risk of delayed or inappropriate treatment.

RECOGNIZING/DIAGNOSING THE PROBLEM

Nonpharmacologic management of ARBs does not so much require determining which diagnostic label to assign to the problem, as it does attempting to identify the underlying affective state or motivation for performance of the behavior. The welfare of the animal is placed in jeopardy if any pain, discomfort, or altered sensation that may be causing or contributing to the repetitive behavior is not carefully ruled out. The role that stress and anxiety may play in the development of certain medical conditions, such as gastrointestinal disease, skin disease, and urinary tract disease, must not be overlooked either. See the chapters by Mills et al and Frank elsewhere in this issue for a review of these conditions.

Once medical conditions are identified and treated, the next goal of the clinician may best be focused on identifying other sources of anxiety that contribute to the performance of the repetitive behaviors. Environments that are unpredictable or understimulating can lead to feelings of conflict, frustration, and anxiety. When routines are disrupted or animals experience chronic, recurring situations that cause fear or anxiety, then displacement, vacuum activities, or redirected behaviors may develop and

become repetitive over time. Inappropriate use of punishment is a common mistake made by pet owners that often leads to fear and anxiety in pets.

The ability to interrupt a repetitive behavior is not necessarily diagnostic for CD or stereotypy. Dogs experiencing seizure activity are difficult if not impossible to stop and may or may not demonstrate the appearance of being disassociated with the environment. The author has witnessed dogs with severe pruritus being equally difficult to interrupt. Many animals, if interrupted often enough, simply learn to move to another area, away from their owners so that they can continue to perform the behavior. Video of the animal alone can be useful in ruling out attention seeking as the cause of repetitive behaviors.

Ruling out focal seizures is challenging because they can be associated with twitching of facial musculature or whole body trembling, as well as unusual behaviors such as frantic running and colliding with objects, piloerection, dilated pupils, and unilateral limb motions with no loss of consciousness. Repeated presentations of this type of seizure activity might be easily confused with an ARB.

There are no clear diagnostic criteria for identifying a CD. It is a diagnosis of exclusion.

MANAGEMENT OF REPETITIVE BEHAVIORS

Pharmacologic Strategies

The challenge of pharmacologic therapy for repetitive behaviors, in addition to not knowing if all repetitive behaviors truly share the same underlying neurophysiology or neuropathology, lies in the fact that it is not known exactly which neurotransmitter systems need to be affected by therapy. Existing information suggests that stereotypies are sensitive to opioid and dopaminergic antagonists early on in their development and once established are only sensitive to dopaminergic control.^{15,67} However, to date, antipsychotic drugs that block dopamine receptors have not been proved to be effective in the treatment of ARBs in animals.

As is the case with many behavioral problems in animals, pharmacotherapy, although not always necessary, can play a useful role in treatment. Pharmacotherapy has been used in a variety of cases of repetitive disorders in pets and has been shown to be helpful in many. The use of several different families of drugs has been documented, and the ones found to be most effective are the serotonin reuptake inhibitors. Beta-endorphin antagonists such as naloxone, naltrexone, and nalmefene have been used to treat repetitive behaviors, but few studies of their use in animals have been published.^{34,54,67} These drugs are, however, expensive and their effects short lived.

- Serotonergic drugs are currently the first line of treatment of OCDs in humans. Clomipramine has been the drug of choice for treatment of animal repetitive disorders for many years, and some studies have found it to be more effective than desipramine or amitriptyline.^{40,50} One study, however, used clomipramine for the treatment of psychogenic alopecia in cats and found no significant improvement.⁶⁸ In a study in which clomipramine was used to treat tail chasing in terriers, 75% of the patients demonstrated a 75% reduction in tail chasing behavior within 1 to 12 weeks.³⁹ Hewson and colleagues⁶⁹ found clomipramine treatment to be effective but not curative in a study of several different types of CDs in dogs. A study using clomipramine to treat anxiety-related disorders and CDs in 10 cats also documented improvement as did another study using clomipramine to treat separation anxiety, noise phobias, and CDs in dogs.^{42,70} However, that multiple different diagnosis may have been represented by the study populations in these 3 papers brings the usefulness of the data into question.

One case report of shadow chasing in a dog used single-photon emission computed tomographic imaging studies to document alterations in the dopaminergic neurotransmitter systems (dopamine transporter [DAT] striatal-to-brain ratios), similar to those in humans with OCD. Clinical improvement was documented in this case after 7 days of treatment with clomipramine, and follow-up scans revealed that the DAT ratios returned to near normal levels.⁴³

- Selegiline blocks monoamine oxidase (MAO)-B from breaking down dopamine, presumably boosting dopaminergic transmission. At higher doses (in humans), it blocks both MAO-A and MAO-B from breaking down norepinephrine, serotonin, and dopamine, potentially increasing transmission of all these neurotransmitters. Although no controlled studies on the use of selegiline to treat repetitive behaviors has been performed, there have been some anecdotal reports of its efficacy in treating compulsive licking.⁷¹ Based on the growing body of knowledge suggesting that dopaminergic transmission and serotonergic transmission may be involved to varying degrees in repetitive behaviors, more research into the efficacy of selegiline is warranted.
- Fluoxetine is another serotonergic drug that has been found effective in treating both stereotypies and CDs in animals.^{30,72–74} However, most studies have examined the drug in laboratory animals.^{75,76} One randomized, placebo-controlled study has been published using fluoxetine in the treatment of CDs. As in previous studies, a variety of different repetitive behaviors were included in the study patients. Although dogs in this study treated with fluoxetine had a significant decrease in owner-reported severity of their CD, evaluation of owner diaries revealed no significant differences in the number or duration of compulsive behaviors documented.³⁰
- Newer evidence suggests that altered glutamatergic transmission may play a role in human OCD; drugs that block the glutamate-sensitive *N*-methyl-D-aspartate (NMDA) receptors have been tried and found effective in treating some cases of OCD in humans. Memantine is one NMDA receptor antagonist that has shown promise in the treatment of canine CDs, as a single agent and in combination with fluoxetine.³³

Nonpharmacologic Strategies

Basic principles

Avoidance of stimuli/triggers Behavioral management of repetitive behaviors begins with the identification and cataloging of as many stimuli or triggers for the behavior as possible. Not all triggers are readily apparent, but clients should be encouraged to keep a journal and describe the environmental conditions immediately before the initiation of the repetitive behavior. With this information, the clinician can help the client identify stimuli with the immediate goal of avoidance. The primary goal is to decrease the percentage of the time the pet engages in the repetitive behavior because repetition increases the likelihood of the behavior continuing.

Videotaping is often an additional step necessary to aid in recognizing triggers. Events that occur while the owner is away from the home may be major precipitating stimuli such as the arrival of delivery personnel or certain sounds or other events. In addition, videotaping in the client's absence helps to verify that the behavior is occurring whether the owner is present or not (to rule out attention-seeking behavior) and document what percentage of the time the animal is performing the repetitive behavior. Videotaping can also serve as a gauge to the severity of the problem, as well as the efficacy of any recommended treatment protocols.

Avoiding all stimuli that trigger the behavior can be challenging, so the clinician and pet owner need to work together to find the most feasible ways to do this in each individual case. In some cases, avoiding leaving the dog alone at home may be helpful and alternatives such as doggie day care, leaving the pet with a relative or friend, providing the pet with a temporary companion such as a friendly conspecific, or providing periodic interactions such as with a pet sitter or walker may be helpful. Every effort should be made to provide the pet with a place in the home where it feels most relaxed and comfortable. This place may be any preferred room or location where the pet is less likely to perform the repetitive behavior, such as a basement, car, or crate. Any and all options should be investigated and used to reduce the likelihood of the repetitive behavior occurring, and the additional methods described later are implemented to decrease overall stress in the environment and teach the pet appropriate alternative behaviors.

Physical prevention of behavior Another option or even necessity may be to physically prevent the repetitive behavior from occurring. Physical barriers that may be helpful include items such as baby gates, crates, and exercise pens (X-pens). In addition, in situations involving SIB, physical restraint may be necessary and would include items such as bandages, body covers, Elizabethan collars, soft neck wraps or braces, and buckets. Research in people indicates that the physical restriction of repetitive behaviors can potentially lead to collateral effects such as an increase in other undesired behaviors or a rebound effect when the restraint is removed.⁷⁷ The rebound effect has been documented in animals as well.⁷⁸ In humans, physically restraining the patient to prevent performance of a repetitive behavior has been shown to be extremely distressing,⁷⁹ so physical restriction should only be used to prevent physical harm while a comprehensive treatment protocol is initiated.

Use of head collar and dragline and/or tether Another way to decrease the percentage of time a pet performs repetitive behaviors is to keep the pet under direct observation and to interrupt the behavior sequence that leads to that repetitive behavior. The use of a head collar or harness along with a dragline allows easy access to the pet and rapid interruption of the behavior sequence and redirection of the pet to a more appropriate activity such as attention directed toward toys or food puzzles. The animal should be redirected immediately before the repetitive pattern begins (this is another reason why it is important for the pet owner to be aware of the stimuli likely to lead to the behavior); otherwise, the owner may inadvertently reinforce the behavior by providing attention to the pet. Tethering the pet to the owner or in immediate proximity to the owner also allows for close supervision of the pet and immediate intervention on an as-needed basis. Head collars may have the additional benefit of inhibiting behavior in some dogs.

Stop all punishment Punishment is not an effective behavior modification tool for most clients, and the use of punishment can be associated with increased aggression and injury.⁸⁰ In addition, as research continues to examine the repetitive behaviors, studies indicate that these behaviors frequently have a genetic and/or biologic basis to them.^{7,31} Because they often occur as a result of conflict or frustration, they are a behavior and welfare concern, not a training issue. Up to 40% of SIBs in humans have an anxiety component associated with them.⁸¹ Punishment increases anxiety and fear, potentially increasing the likelihood of a repetitive behavior being performed. Positive reinforcement or reward-based training should be used to decrease arousal, anxiety, and fear and to increase the likelihood of acceptable alternative behaviors occurring.

Environmental modification

Exercise Although there are no data indicating that exercise per se decreases repetitive behaviors, in general, most companion animals lead inactive lifestyles. The effect of regular exercise on the behavior and attitudes in humans is well documented.⁸² Adoption of the 30 minutes of exercise for a minimum of 5 days a week guidelines established by the Center for Disease Control and Prevention for the maintenance of basic health should be a common sense starting point.⁸³ Walks provide the added benefit of enrichment by changing the animal's environment. Allowing a dog time to sniff and explore within the range of the leash can be enriching, as it allows the dog to exercise its exceptional sense of smell. This type of mental activity is a form of exercise that may be equally as beneficial as physical exercise. Just about any method of increasing activity should be acceptable as long as the activity does not increase the incidence of repetitive behaviors and the pet engages in the activity willingly.

Occupational training behaviorally appropriate activities Some researchers hypothesize that repetitive behavior originates from frustrated inherent behaviors.¹⁶ Based on that theory, providing occupationally appropriate activities may decrease the incidence of stereotypes.³³ Examples would include terrier trials or digging pits for terriers, lure coursing or chasing fishing pole toys for sight hounds, herding opportunities including Treibball for herding breeds, tracking test or K9 Nose Work for scent hounds, and so on.

Environmental enrichment Environmental enrichment is covered elsewhere in this issue by Heath and Wilson. Enrichment can be provided at multiple levels and should engage all the senses. Being visually oriented, humans focus on visual stimuli, but scent and sound are likely to be much more important to companion animals. The use of pheromones, lavender, and catnip, as well as the use of classical music and natural sounds, can contribute positively to the quality of the animal's environment.⁸⁴

Behavior modification

Predictable routines and interactions Stress is thought to play a significant role in the exacerbation of repetitive behaviors.⁸⁵ A predictable environment decreases stress, so the establishment of a routine is helpful. In addition, predictable, consistent interactions, referred to as a command (or cue) -response-reward interactions, help to further improve the pet-client bond. If the pet wants anything from the owner, the pet needs to do something to earn what the pet wants. If the pet responds to a cue, the pet is given access to what it wants, as well as verbal praise, and depending on the situations, food rewards. If the pet does not perform, it is ignored or redirected to another acceptable activity; this makes interactions predictable and structured. There are no penalties for failing to respond, but the pet is rewarded for responding appropriately. Command-response-reward interactions enhance the relationship, provide structure, and improve communication between the pet and the owner. Clear communication results in less anxiety associated with pet-owner interactions and gives the pet a reason to be more attentive to the owners' requests.

Teach relaxation If anxiety is contributing to the behavior, teaching the pet to relax is extremely helpful. There are several published protocols for teaching a pet to relax on cue.⁴⁶

Ignore attention seeking, reward/reinforce relaxed behavior Ignoring attention seeking and rewarding and reinforcing relaxed behavior also contributes to decreasing overall anxiety. Attention-seeking behavior can include nudging, pawing,

following, whining, crawling up on the owner, and possibly even the repetitive behavior itself. This behavior often occurs as a result of anxiety and the pet being unable to settle down and relax on its own. The animal needs to learn better coping skills and to not be so reliant on the owner for constant feedback. All attention-seeking behaviors should be ignored except repetitive behaviors that need to be interrupted as early in the cycle as possible. If the pet is persistent, the owner may have to move or redirect the pet, but they should not acknowledge the pet with eye contact or verbal instruction. Punishment, including saying things such as “No” or “Stop,” should never be used for the reasons previously discussed; for some dogs, punishment is actually attention. Quiet praise should always be provided whenever the pet shows any inclination to be by itself or entertain itself. Food toys should be offered as mental exercise, possible distractions, and to encourage quiet independence.

Countercondition the pet to respond to the stimuli by performing an alternative behavior that is incompatible (response substitution) There are several behaviors that can be trained that may serve as an alternative to the repetitive behavior. Targeting, looking at the owner, and sitting are probably the most commonly used alternatives or “interrupters.” As the pet is exposed to the provocative stimuli and begins to initiate the repetitive behavior, the owner requests that the pet “touch,” “watch me,” or “sit,” in order to interrupt the behavioral sequence and prevent the repetitive behavior from occurring. Timing is crucial. Once the pet is fully engaged in the repetitive behavior, it may be difficult to interrupt. A head halter or harness with dragline or tether can be extremely helpful in implementing this behavior modification. Drug therapy also plays a key role in raising the arousal threshold and providing the client with additional time to be able to interrupt and prevent the behavioral sequence. The goal would be to have the pet begin to associate the stimulus that previously triggered the repetitive behavior with the new incompatible behavior and through operant conditioning learn a new, acceptable response to the stimuli.

Desensitization to stimuli and classic counterconditioning (reward calm behavior) If the triggers can be identified, isolated, and controlled, it may be possible to change the pet’s internal response to the stimuli by pairing the stimuli with something desirable such as food. If, for example, the repetitive behavior is triggered by the sound of the doorbell, it may be possible to record the doorbell. Then while playing it at a volume so low that it does not trigger the repetitive behavior, begin pairing that sound with high-value food treats while cueing the pet to relax (see teaching relaxation discussed earlier). It may be possible to change the pet’s emotional response to stimuli through food to one of rewarded relaxation.

EVALUATION, ADJUSTMENT, AND RECURRENCE

Most documented attempts to treat repetitive behaviors do not stop the behavior completely, and if it does, effects are often short term. Clients should be informed that there is much to learn about the actual causes and neurobiology underlying these behaviors, so treatment strategies are empiric at best.

- If the animal is responding to aspects of its environment that cause anxiety or stress, the repetitive behaviors may reoccur throughout its life any time that these conditions arise again.
- Animals that fail completely to respond to the recommended treatment program within 4 to 8 weeks should be carefully reevaluated for underlying disease processes and the presence of pain or neuropathy.

- Although many pet owners do not see repetitive behaviors as a problem, the practitioner, as an advocate for the pet should be prepared to educate owners about the possibility that it is reflective of poor animal welfare.
- The overriding goal of treatment should be aimed at eliminating or at least minimizing any chronic anxiety that the animal may be experiencing.

SUMMARY

Although much has been learned about the repetitive behavior in both humans and animals during the past 50 years, the neurophysiology underlying these problems remains unclear. Repetitive behaviors represent such a diverse array of behaviors in a large variety of species that it is possible that most do not even share the same underlying pathologic condition. Until more is known about what causes the different repetitive behaviors in animals, it may be best to avoid assigning them a particular label such as CD or stereotypy. The evidence is growing that stereotypies and compulsive/impulsive disorders have different neurophysiologic underpinnings, so the 2 terms should not be used interchangeably. To further complicate matters, it is becoming increasingly likely that many of the repetitive behaviors in dogs and cats may occur secondary to underlying disease processes not related to the neurologic system. Diseases or disorders causing pain or discomfort should never be overlooked too quickly simply because diagnostic tests initially fail to reveal a cause. Because these patients cannot speak, it behooves the practitioner to err on the side of caution and rule out pain or discomfort via empiric treatment if suspected, before assuming the condition is a mental health one. If signs of conflict, frustration, fear, or anxiety are apparent in the animal's environment, appropriate management for that problem is also necessary to treat the patient successfully.

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