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Compulsive Behavior in Companion Animals (22 September 2000)

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Introduction
It has long been recognized that otherwise healthy dogs, cats and most other species kept in captivity, may develop strange abnormal behaviors. These behaviors appear abnormal because they are performed out of context, are often exaggerated, directed towards unnatural stimuli or objects, and are often repeated in a constant manner. Examples of such behavior are listed in Table 1.

Table 1. Examples of Compulsive Behaviors

Locomotion	Circling, tail chasing, pacing, jumping in place, chasing light reflexes, freezing, dashing off, sudden agitation, skin ripple (feline hyperesthesia syndrome)
Oral	Chewing legs or feet, self licking (lick granuloma, psychogenic dermatitis), air or nose licking, flank sucking, scratching, chewing or licking objects, polyphagia, polydipsia, pica, wool sucking, "fly" snapping
Aggression	Self directed aggression, e.g., growling at hind end, attacking legs or hind end, attacking tail, attacking food bowl, attacking inanimate objects. Unpredictable aggression to people?
Vocalization	Rhythmic barking, persistent meowing/howling
"Hallucination"	Avoiding imaginary objects, staring at "shadows", startling

In companion animals, such behaviors have been regarded by many as seizures, and possibly expressions of other neurological defects such as hydrocephalus. Interestingly, in other species such behaviors, particularly the stereotypic ones, have always been considered to be confinement-induced conflict behaviors, and have been linked to specific husbandry practices [1]. An important break-through in the understanding of these abnormal behaviors in companion animals came when the parallel was drawn between them and the stereotypic behavior of livestock and zoo animals [2]. Another important breakthrough was the recognition that these behaviors shared similarities with human obsessive compulsive disorder [3]. The recognition of these facts allowed for the development of working hypotheses on the origin, the development, and the neurophysiology of these behaviors.
Our group (Ontario Veterinary College and now Purdue University) has chosen to call the behaviors "Compulsive" rather than to use the human term "Obsessive Compulsive" [4], since at present we don't know the extent of the similarities between the human and the canine condition.
Although a beginning has been made to validate the diagnosis of Compulsive Disorder [5] further work is needed. As a working definition of Compulsive Disorder (CD), Hewson and Luescher (1996) [4] proposed:

"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 (e.g. 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".

Causes of Compulsive Disorder

Compulsive behaviors are considered to be an expression of stress, frustration, and/or conflict [2]. Frustration refers to the situation in which an animal is motivated to perform a behavior, but prevented from doing so. The term conflict may be used as a general term including frustration, or may specifically refer to motivational conflict, i.e. the conflict resulting from two opposing, similarly strong motivations (such as approach and withdrawal). Various forms of conflict behaviors are caused by frustration or conflict and have been studied in a great variety of species [6]. Prolonged and particularly repeated frustration and conflict may result in the conflict behaviors developing into compulsive disorder.

From clinical cases it is quite obvious that there are some compulsive behaviors that are more or less breed specific. Breed pre - dispositions for compulsive behaviors are listed in Table 2. This observation indicates that there may be genetic factors controlling the development of CD: some breeds may be particularly susceptible to developing a CD, others may develop a particular compulsive behavior if the environment is conducive to the development of CD.

Physical lesions or irritations, such as ones caused by allergy, appear to trigger CD in some cases. It is assumed that the stress associated with a lesion or irritation can contribute to the development of CD in an already susceptible animal, and that the irritation can initially direct the compulsive behavior towards a particular body site. Cases in which a dog starts licking a lesion or sutures, but then starts to also lick other parts of the body and causes lick granulomas in sites unrelated to the lesion, support this theory.

Owner attention may reinforce existing compulsive behaviors, or condition normal conflict behaviors to the extent that they appear compulsive. Performance of the behavior only in the owner's presence is suggestive of a conditioned behavior. Disease that increases stress and/or irritability may contribute to CD, as may other stressful behavioral problems (e.g. a dominance conflict or separation anxiety) or certain temperament traits (e.g. fearfulness).

Table 2. Apparent Breed Predispositions for Compulsive Behaviors

Doberman Pinscher	Flank sucking
English Bullterrier	Spinning in tight circle Sticking head under or between objects and freezing
German Shepherd	Tail Chasing
Miniature Schnauzer	Checking hind end
Large breed dogs	Persistent licking causing granulomas
Siamese/Burmese	Wool sucking

Pathophysiology of Compulsive Disorder

The pathophysiology of CD is not well understood. Most evidence stems from drug effects on the performance of compulsive behavior. Large doses of dopaminergic drugs such as amphetamine and apomorphine are effective in inducing stereotyped behavior in animals, while the dopamine antagonist haloperidol results in suppression of spontaneously occurring stereotyped behavior [7].

Beta-endorphins have been implicated in stereotypy performance because beta-endorphin receptor blockers can be effective in reducing stereotypies. However, the concept that performance of stereotypies is rewarded by endorphin release is no longer supported: cribbing in horses did not result in an increase in blood endorphin levels, and their pain sensitivity was actually increased during cribbing compared to when they were not cribbing [8]. Furthermore it has been suggested that beta-endorphins may play a significant role only early on in the development of stereotyped behavior [7]. Because of similarities of animal CD and human obsessive compulsive disorder, drugs inhibiting serotonin re-uptake have been used to treat dogs with CD [3]. The effectiveness of such drugs implies that serotonin is involved in animal CD. Direct evidence of serotonin involvement has also been presented [9]. However, the role of serotonin in CD is not well understood [10].

Development of Compulsive Behavior

From clinical data it appears that many cases diagnosed with CD may follow the pattern of development as suggested in the above working definition, but others may not. The definition implies that compulsive

behaviors are first shown in a conflict situation (acute or normal conflict behavior), but with prolonged or repeated conflict, may be shown in any other context which cause high levels of excitement. Although further analysis of case material is required to make a definitive statement, it appears that this concept of development applies to locomotory compulsive behaviors. Oral self-directed behaviors, however, seem to be displayed one day without identifiable initial conflict, and are performed at a constant rate in contexts with little outside stimulation, i.e. when the animal appears quiet (although its arousal level may be high). It often appears as if the dog had to perform the oral compulsive behavior in order to be able to settle down.

There is, thus, some evidence that CD is not a homogenous condition, and that there may be two or several classes of compulsive behavior. Further evidence comes from neurophysiological studies which suggest that oral and locomotory stereotypic behaviors may be controlled by different brain systems [11]. It appears, though, that all compulsive behaviors are related to arousal resulting from conflict and/or stress, and clinically, there does not appear to be a difference in response to treatment between locomotory and oral compulsive behaviors. In a clinical trial involving 51 dogs with CD, the type of behavior shown did not affect the response to treatment with clomipramine [12].

Diagnosis

There is no gold standard for the diagnosis of CD. Diagnosis is based on observation of the behavior, historical data, and exclusion of medical conditions.

Diagnosis of CD is primarily based on a detailed history. It has to include information on the development of the problem, the life history of the animal, a description of the contexts in which the behavior was shown initially and in which it is shown now. Description of incidents should include time of day and location, other individuals present, their behavior before the compulsive behavior is performed, a description of the behavior itself, the owner's reaction to the behavior and the animal's actions after terminating the compulsive behavior. The ease or difficulty with which the animal can be distracted and previous treatment attempts should be noted as well.

Compulsive behaviors are always displayed outside of their natural context, usually in several different contexts, and/or are excessive. They are often directed towards unusual target objects, and are frequently repetitive or sustained. The animal is in full consciousness while performing the behavior and aware of its surroundings. The behavior can usually be interrupted (although sometimes very strong stimuli are necessary), and the animal does not exhibit a post-ictal phase characteristic of seizures. Their performance is not dependent on the owner's presence. Locomotory compulsive behavior and fly snapping are typically initially shown in a specific conflict situation, later in an increasing number of situations in which the animal is excited. Self directed oral compulsive behaviors are likely to be shown in situations with little external stimulation.

Minimum medical data-base includes normal physical and basic neurological exams, CBC, chemistry profile and urinalysis. Differential diagnosis must consider acute conflict behavior, which is normally shown by animals in situations of conflict or frustration. Another rule-out is operantly conditioned behavior, i.e. behavior that was performed once, possibly in a conflict situation, and persisted because of some form of reinforcement (usually owner attention). Neurological disorders can cause repetitive behavior such as circling, skin conditions could result in persistent and excessive licking, etc. Some systemic diseases and hyperkinesis may need to be considered as well [4].

Treatment

Treatment consists of environmental and behavior modification and, usually, pharmacological intervention. In the following, treatment is listed in order of implementation. Steps are summarized in Table 3.

1. If possible, the cause of the problem should be identified and removed. In some cases, particularly in cases of self-directed oral behavior, an environmental cause cannot be identified. In other cases, an inciting cause can be identified but not removed; e.g., some cases may start out as separation anxiety, and then develop into CD. The cause cannot be removed: the owner needs to keep going to work. In such cases, it may be possible to desensitize the animal to the stressful situation (i.e., treat separation anxiety. The planned departure technique sometimes used for this is a desensitization procedure).
2. Stressors may be additive, and once a compulsive behavior is established, environmental stress may serve to perpetuate it. Therefore, it is indicated to try to reduce environmental stress as much as possible. The most stressful situation for an animal is one over which the animal has no control and in which the animal cannot predict what is going to happen. Casual owner - animal interactions are

usually inconsistent and thus add to stress. They should be avoided and replaced with highly structured interactions in form of command - response - reward. Formal obedience sessions allow for such consistent interaction with dogs, and also are likely to render the owner's behavior towards the dog more consistent in the long term. In cats, we recommend regular quality time at a time of day when it always can be provided. The owners are advised to play with the cat with toys (maybe even teach them to retrieve).

Punishment, e.g. scolding, is frequently applied by owners. If the animal is to associate punishment with the undesirable action, it has to be delivered every time the behavior is performed, immediately after the behavior is performed, and at the right intensity. Since it is practically impossible to apply owner-related punishment correctly, such punishment is unpredictable and thus stressful, and should not ever be used in affected animals. Sufficient exercise provided to dogs on a regular schedule, and a large variety of toys that are rotated, may serve as an unspecific means of decreasing arousal, and add structure to the day.

3. In most cases, particularly in those that have been going on for a long time, drug therapy may prove necessary. Therefore, beta-endorphin antagonists such as naloxone, nalmefene and naltrexone have been suggested to be used for treatment. Beta-endorphin antagonists have high first pass metabolism and a short half-life, and most are only effective as injectables. Only naltrexone is available as an oral formulation, because in humans its first metabolite, 6-beta naltrexol, is an active beta-endorphin antagonist. However, this metabolite is not formed in dogs [13], and clinical suppression of compulsive behavior is short-asting [14]. In spite of a report supporting its effectiveness at 2.2 mg/kg po sid - bid [15], its use for the treatment of CD must be questioned.
   A dose for haloperidol has not been established for companion animals. Landsberg et al., (1997) [16] list 1 - 4 mg per dog bid po. This author has used it in only a few cases at 1 - 2 mg per dog, invariably with adverse effects.
   As is the case with human obsessive compulsive disorder, pharmacological intervention is most likely achieved with serotonin re-uptake inhibitors. A clinical trial involving 51 dogs with a variety of compulsive behaviors has been performed for the tricyclic antidepressant, clomipramine [12]. Clinical trials on cases of acral lick dermatitis have been performed for clomipramine, fluoxetine and sertraline [17]. Paroxetine has also been used clinically, but its effect has not been evaluated. Recommended drugs, dose rates, side effects and contra-indications are listed in Table 3. We usually give the drug for three weeks after it appears to have an effect, and then wean off gradually by giving 3/4 dose for one week, 1/2 dose for one week, 1/4 dose for one week, and then discontinue the drug completely. If during the weaning process the behavior reappears, the dose is increased again and maintained at the effective level for some time before resuming weaning. It is extremely important to wean re-uptake blockers off gradually. During treatment with re-uptake blockers, neurotransmitter accumulates in the synapse. Among other effects, this results in a down-egulation of the receptors. Once the drug is discontinued, the amount of neurotransmitter in the synapse is suddenly much lower, but the receptors remain down-regulated for some time. This may result in a rebound effect, i.e., the compulsive behavior may reappear worse than ever.
4. In persistent cases, or if the owner is opposed to the use of drugs, a program of counter-conditioning (more correctly termed response-substitution) can be implemented. If this option is chosen, treatment has to be implemented with great consistency in order to be effective. It is very important that the animal never be given a chance to perform the compulsive behavior.
   In dogs, the patient is initially trained with positive reinforcement to perform a desirable behavior which is incompatible with (i.e., cannot be performed at the same time as) the compulsive behavior. A dog licking his carpus might be trained to lie with his head on the floor between his paws. Whenever the dog cannot be supervised, he is put into a situation where he cannot perform the compulsive behavior (e.g., an Elizabethan collar is placed around his neck). As often as the dog can be closely supervised (we often recommend to use an "umbilical cord", i.e., the dog is attached to a person with a leash), the restraint (e.g., collar) is removed. Every time the dog shows any inclination to perform the compulsive behavior, he is distracted (if necessary by pulling on a leash connected to a head halter). The command for the alternate behavior is then given. The dog either performs or is made to perform the alternate behavior, and is then rewarded. The reward can be progressively delayed, so that the dog has to stay in the chosen position for increasingly longer times before the reward is given.
   The distraction is very important. If the dog is not distracted before a command (i.e., attention) is given, the treatment attempt could result in aggravation of the problem through inadvertent reinforcement of the behavior.
   In cats we recommend a similar program. The cat is continuously supervised or placed in a position

in which it will not perform the behavior. Every time the cat is about to perform the compulsive behavior, it is distracted (startled), and then its attention reoriented by throwing a toy.

Table 3. Steps in Treatment of Compulsive Disorder

1. Identify and remove cause of conflict. Desensitize to stress-inducing situation.
2. Avoid inconsistent interactions (i.e. ignore most of the time). Provide structured interaction in terms of command - response - reward or structured games. Obedience training.
3. Avoid all forms of owner administered punishment.
4. Provide sufficient exercise on consistent schedule, or activity (toys).
5. Drugs:
   clomipramine (Clomicalm, Novartis) Canine: 2 - 3 mg/kg bid; Feline: 0.5 - 1 mg/kg sid.
   Side effects: sedation, urine retention (cats!), change in appetite, diarrhea, vomiting. Also, lowering of seizure threshold and arrhythmias. The drugshould be given with food to reduce likelihood of gastrointestinal upset.
   Contra-indications: liver disease, history of seizures, cardiovascular problems, simultaneous use of thyroid medication, simultaneous use of MAO inhibitors (such as Deprenyl), glaucoma. Diabetes mellitus patients may be difficult to regulate.
   Fluoxetine (Prozac, Eli-Lilly) or paroxetine (Paxil, SmithKline Beecham) Canine: 1 mg/kg sid; Feline: 0.5 - 1 mg/kg sid or paroxetine 2.5 mg/cat q 24 - 48 hrs.
   Side effects: sedation, anxiety, animal seems "withdrawn", loss of appetite. Possibly lowering of seizure threshold.
   Contra-indications: simultaneous use of MAO inhibitors. Diabetes mellitus patients may be difficult to regulate.
6. Counter-conditioning: when unsupervised, the animal should be prevented from performing the compulsive behavior. When supervised, as soon as the animal intends to perform the behavior, it is startled. Dogs are then given a command, and the appropriate behavior is rewarded. Cats may be distracted by throwing a toy.

Prognosis

At the behavior clinic of the Ontario Veterinary College, the above treatment strategy resulted in approximately 2/3 of owners being satisfied with the outcome. The remaining 1/3 included owners with poor compliance, as well as owners who elected not to attempt treatment. A case-load analysis revealed that outcome was negatively affected by problem duration [18]. It is therefore important to treat CD as early as possible.

References

1. Wiepkema PR. Abnormal behaviours in farm animals: ethological implications. Neth J Zool 1985; 35:279-299.
2. Luescher UA, McKeown DB, Halip J. Stereotypic and obsessive-conpulsive disorders in dogs and cats. Vet Clin North Am Small Animal Pract 1991; 21:401-413. - PubMednbsp;-
3. Goldberger E, Rapoport JL. Canine acral lick dermatitis: response to the antiobsessional drug clomipramine. J Am Anim Hosp Assoc 1990; 27:179-182.
4. Hewson CJ, Luescher UA. Compulsive disorder in dogs. In: VL Voith and PL Borchelt eds. Readings in Companion Animal Behavior. Trenton, NJ: Veterinary Learning Systems, 1996;153-158. - Available from amazon.com -
5. Hewson CJ. Clomipramine in dogs: pharmacokinetics, neurochemical effects, and efficacy in compulsive disorder. PhD thesis, Ontario Veterinary College, Guelph, Ontario, Canada 1997.
6. Hinde RA. Animal Behavior ed 2. New York, NY: McGraw Hill, 1970; 396-421.
7. Kennes D, Odberg FO, Bouquet Y, DeRycke PH. Changes in naloxone and haloperidol effects during the development of captivity induced jumping stereotypy in bank voles. Eur J Pharmacol 1988; 153:19-24. - PubMed -
8. Lebelt D, Zanella AJ, Unshelm J. Changes in thermal threshold, heart rate, and plasma beta-endorphin associated with cribbing behavior in horses. In: Proceedings of the Int Soc Appl Ethol, 1996; p 28
9. Vanderbroek I, Odberg FO, Caemaert J. Microdialysis study of the caudate nucleus of stereotyping and non-stereotyping bank voles. In: Proceedings of the Int Soc Appl Ethol, 1995; p 245.
10. Insel TR, Zohar J, Benkelfat C, Murphy DL. Serotonin in obsessions, compulsions, and the control of

aggressive impulses. Ann N Y Acad Sci 1990;600:574-585.
11. Cabib S . Neurobiological basis of stereotypies. In: AB Lawrence and J Rushen, eds. Stereotypic Animal Behavior: Fundamentals and Applications to Welfare. Wallingford, Oxon, UK: CAB International, 1993; 119-145. - Available from amazon.com -
12. Hewson CJ, Luescher UA, Parent JM, Conlon PD, Ball RO. Efficacy of clomipramine in the treatment of canine compulsive disorder. J Am Vet Med Assoc 1998; 213:1760-766. - PubMed -
13. Garrett ER, el-Koussi Ael-D. Pharmacokinetics of morphine and its surrogates V: Naltrexone and naltrexone conjugation pharmacokineticsin the dog as a function of dose. J Pharm Sci 1985; 74:50-56. - PubMed -
14. Dodman NH, Shuster L, White SD et al. Use of narcotic antagonists to modify stereotypic self-licking, self-chewing and scratching behavior in dogs. J Am Vet Med Assoc 1988; 193:815-819. - PubMed -
15. White SD. Naltrexone for treatment of acral lick dermatitis in dogs. J Am Vet Med Assoc 1990; 196:1073-1076. - PubMed -
16. Landsberg G, Hunthausen W, Ackerman L. Handbook of Behaviour Problems of the Dog and Cat. Oxford: Reed Educational and Professional Publishing Ltd., 1997; 211. - Available from amazon.com -
17. Rapoport JL, Ryland DH, Kriete M. Drug treatment of canine acral lick: an animal model of obsessive-compulsive disorder. Arch Gen Psychiatry 1992; 49:517-521. - PubMed -
18. Luescher AU. Factors affecting the outcome of behavioral treatment. Am Anim Hosp Assoc, San Diego, CA, USA, 1997.