

Hyperkinesis in dogs: Six case reports

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Hyperactivity in dogs is a common complaint. In most cases, the hyperactivity is not due to a physiological disorder, but is either normal behavior for the breed or behavior inadvertently conditioned by the owner paying undue attention to it (1-3). Treatment in these cases involves ignoring the activity, redirecting activities to appropriate target objects, and conditioning the animal to an appropriate behavior in lieu of the unwanted activity (2). Punishment is rarely useful because usually it can not be applied properly, i.e. consistently, with proper timing and at the correct intensity. Punishment also tends to increase arousal levels and does not encourage desirable behavior.

However, some cases of hyperactivity or hyperexcitability are the result of a physiological disorder. Initially identified in laboratory dogs as an animal model for hyperkinesis or attention deficit disorder in children (4,5), hyperkinesis has also been reported to occur in the pet dog population (6,7). Signs exhibited by these dogs include tachycardia, panting, salivation, antidiuresis, lack of trainability, and failure to habituate to external stimulation (6,7). The pathophysiology underlying the problem is still unclear. It is hypothesized that in children the activity of a regulatory dopaminergic system originating in the midbrain and connected with other parts of the brain, in particular the frontal cortex, is somehow disrupted (8). In the normal individual, this regulatory system is thought to function as an inhibitory mechanism that modulates arousal in response to stimuli, and thus allows for focusing of attention (9). Investigations on hyperkinetic dogs have mostly implicated dopamine, but also norepinephrine and serotonin in the pathogenesis of the disorder (4-6,10).

Differential diagnosis can not be made by clinical signs alone. However, since the disorder is presumably caused by dysfunction of a dopaminergic system, a simple diagnostic test can be performed using the indirect dopamine agonist, dextro(d)-amphetamine. Particulars of the test are described in detail by Campbell (6). The dog is taken to a small examination room (signs of hyperkinesis are exacerbated by confinement) and its activity levels, pulse, respiration, and salivation are noted. The dog is then given 0.2 mg/kg body weight (BW) d-amphetamine *per os* and taken to a holding area. After 75 minutes (in our experience, effects are often seen much earlier, i.e. after 30 minutes) the dog is taken to a (different) examination room and measurements are repeated. A reduction in the measurements indicates that the dog is hyperkinetic.

Treatment can be successful with stimulants, such as d-amphetamine or methylphenidate. Voith (3) recommends initiating treatment with d-amphetamine

at a low dose of 0.2 mg/kg BW and increasing the dose by daily increments of 0.2 mg/kg BW until an effective dose is achieved. The suggested dose for methylphenidate is 2.0 mg-4.0 mg/kg BW. The drugs may have to be given two or three times per day, and an effective dose is established in consultation with the owner. Drug treatment is only a temporary measure and should be considered an adjunct, albeit a necessary one, to behavior modification (6).

The case histories of six hyperexcitable dogs that responded positively to a challenge with amphetamine are presented. Two of these had been solicited for a research project involving hyperexcitable dogs, the other four stemmed from our case load at the Ontario Veterinary College. Behavior consultations, usually by telephone, and follow-up calls were performed by the author. Physical examination of the dogs and the test for hyperkinesis were performed by the referring veterinarians after they had been instructed by the author on how to perform the test. Instructions were based on Campbell (6) with minor modifications. In particular, in several cases, the dogs were maintained in the same area throughout the trial, and the heart and respiratory rates were measured repeatedly, immediately before drug application and in 30 minute intervals thereafter. Veterinarians reported the test results to the author and consulted with him regarding medication. The author then advised the owners over the telephone on how to proceed with behavioral treatment. This generally included ignoring the dog, particularly when excited, training the dog to remaining quiet, basic obedience training, not using any form of punishment, and regular exercise using a head halter for control. In addition, specific advice was given in each case for treatment of concurrent behavior problems. Characteristics of the six cases, drug treatments, and outcome are summarized in Table 1.

Cases of hyperkinesis are not easily recognized. Campbell (6) lists five cardinal signs of hyperkinesis: sustained tachycardia, persistent hyperpnea, excessive salivation, increased energy metabolism, and antidiuresis. In our cases, tachycardia and hyperpnea were common, but they were not permanent, and the dogs did settle down when in a quiet environment. Salivation was reported in only two of the six dogs and antidiuresis was never observed. The behavioral signs of hyperexcitability listed by Campbell (6) were typical for our dogs: they were very active, kept responding excessively to everyday stimuli, were very hard to train, and in particular, performed very poorly on a sit-stay or down-stay command. Barking, chewing and pacing, and an increase of excitement when confined were also reported. However, most of the cases discussed here had originally been presented not for hyperexcitability, but for one or two concurrent behavior problems. It seems that hyperexcitable dogs in general, and hyperkinetic dogs in particular, by virtue of their hyperexcitability are prone to exhibit other behavior problems. Maybe one characteristic of these dogs that

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Table 1. Diagnostic tests and treatment of hyperkinesis in six dogs

Case No.	Breed	Age ^a	Sex	Weight (kg)	d-amph ^g 0.1–0.2 mg/kg body weight				Treatment			
					before		after		Drug	Adjusted dose (mg)	Duration	Outcome
				P ^b	R ^c	P	R					
1	German shepherd	1.5 yr	FS ^d	35	168	Panting	120	Normal	d-amph	10.0 bid-tid	9 wk	Transient improvement, but inconsistent response to drug
2	Samoyed	2 yr	MC ^e	35	132	88	96	28	d-amph	7.5 bid-tid	Permanent	Greatly improved
3	Spaniel x Labrador	2 yr	FS	20	120	80	80	60	d-amph	10.0 bid	—	Effective for 3 days only. Increased dose produced side effects. No effect
									busp ^h	10.0 tid		
4	Boxer	7 mo	M ^f	27	132	Panting	76	36	d-amph	15.0 tid	5 mo	Transient improvement. Euthanasia due to aggression
5	Yorkshire terrier	3 yr	FS	6	80	—	60 ^j	—	d-amph	5.0 bid		Not effective
									m-phen ⁱ	7.5 tid	7 wk	Much improved
6	Samoyed	2 yr	MC	20	160	Panting	103	Slight panting	d-amph	7.5 tid	Just initiated	Quieter

^aAge = age when presented (age when problem started varied between two and 14 months)

^bP = pulse rate

^cR = respiration rate

^dFS = spayed female

^eMC = castrated male

^fM = intact male

^gd-amph = dextro-amphetamine

^hbusp = buspirone (Buspar, Bristol Laboratories of Canada, Montreal, Quebec)

ⁱm-phen = methylphenidate (Ritalin, Ciba Pharmaceuticals, Mississauga, Ontario)

^jTest performed with 0.5 mg/kg body weight d-amphetamine. Dog had been negative on 2.0 mg/kg body weight

provides an indication for testing for hyperkinesis is the simultaneous occurrence of several and severe behavior problems not usually seen together in one dog. For instance, dog 1 was generally very submissive, but later also showed typical signs of dominance in some situations. Dog 3 had separation anxiety and dominance, dog 4 separation anxiety and territorial aggression, and dog 5 fear and dominance. While these combinations do sometimes occur in physiologically normal dogs, it appears that they are typical in hyperkinetic individuals.

The diagnostic test for hyperkinesis is not without its problems. The results are sometimes inconclusive, and those of repeated tests do not always agree. Dog 5, for instance, was considered to be negative when tested with 0.2 mg/kg BW d-amphetamine, with a transient slight increase in heart rate from 72 to 76 one hour after amphetamine, but positive when tested with 0.5 mg/kg BW d-amphetamine. The successful treatment indicates that this dog was indeed hyperkinetic. A one-year-old, castrated male Dalmatian that exhibited extreme hyperexcitability, pacing, and separation anxiety was positive on first test (heart rate was 84 before and 60 one hour after 0.2 mg/kg BW d-amphetamine), but negative on the second test (heart rate increased from 78 to 84). The dog responded very poorly to methylphenidate treatment, but was success-

fully treated with clomipramine at a very high dose (4 mg/kg BW bid) for two months.

A negative test for hyperkinesis cannot be taken as an indication that the dog is physiologically normal. Some cases of hyperexcitability seem to involve imbalances in neurotransmitters other than dopamine. Bareggi *et al* (10) implicated noradrenaline, and Campbell (6) reported to have had success in two cases by switching treatment from amphetamine to ephedrine. The case of the Dalmatian mentioned above, which responded poorly to methylphenidate as well as amitriptyline but was treated successfully with clomipramine, would indicate that serotonin can be involved as well.

Medication for hyperkinesis can often be discontinued after a relatively short time period (6,7). Case 2 suggests, however, that in some cases treatment has to be prolonged, possibly for the remainder of the dog's life.

Campbell (6) indicates a fairly high chance for satisfactory outcome of treatment. In our cases, success of treatment with stimulants was moderate. The main reason for failure was that the dogs stopped responding to the drug before behavioral treatment could be effective. However, not all of our dogs had been on amphetamine as well as on methylphenidate.

All cases described here had been treated initially with behavior modification techniques for various lengths of time. However, the dogs did not respond to such treatment alone, and drug therapy was essential for the successful treatment of some of these dogs. In fact, prolonged attempts to treat without drugs tended to exhaust the patience of the owners, and jeopardized compliance and commitment for the necessary behavioral treatment once the dog was put on a drug. To ensure that hyperkinetic dogs are tested without undue delay, a prospective study is needed to establish criteria by which candidates for the diagnostic test can be identified early.

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