

Behavioral Changes Associated with Thyroid Dysfunction in Dogs

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In North America, the principal reason for pet euthanasia stems not from disease, but undesirable behavior. While this abnormal behavior in dogs and cats can have a variety of medical causes, it also can reflect underlying problems of a psychological nature.

Inheritance has been shown to play an important role in the behavior of both animals and humans. The role of inheritance in behavior was reviewed by Plomin (*Science* 248:183-188, 1990), who pointed out that the genetic influence on behavioral disorders rarely accounts for more than half of the phenotypic expression of behavioral differences. Each of the multiple genes involved has a small effect on behavior. Development and application of newer techniques in molecular biology offers the promise of identifying the DNA marker sequences responsible for behavioral variation. However, behavior is the most complex phenotype because it reflects not only the functioning of the whole organism but also is dynamic and changes in response to environmental influences. With respect to animal behavior, applied behavioral genetics was first studied several thousand years ago because animals were bred and selected for their behavior as much as their conformation. The results can be attested to by the dramatic differences in behavior and physique among various dog breeds. Today these breeds have a great range of genetic and behavioral variability.

Many investigators in recent years, have noted the sudden onset of behavioral changes in dogs around the time of puberty. Most of the dogs have been purebreds or crossbreds with an apparent predilection for certain breeds. For a significant proportion of these animals, neutering does not alter the symptoms and in some cases the behaviors intensify. The seasonal effects of allergies to inhalants and ectoparasites such as fleas, followed by the onset of skin and coat disorders including pyoderma, allergic dermatitis, alopecia, and intense itching, have also been linked to changes in behavior.

Another interesting association which has been increasing in frequency is the link between thyroid dysfunction and aberrant behavior. Typical clinical signs include unprovoked aggression towards other animals and/or people, sudden onset of a seizure disorder in adulthood, disorientation, moodiness, erratic temperament, periods of hyperactivity, hypo-attentiveness, depression, fearfulness and phobias, anxiety, submissiveness, passivity, compulsiveness, and irritability. After the episodes, a majority of the animals were noted to behave as if they were coming out of a trance-like state and were unaware of their previous behavior.

A similar association between behavioral and psychologic changes and thyroid dysfunction has been recognized in humans since the 19th century, and more recently has been noticed in cats with hyperthyroidism. In a recent human study, 66% of patients with attention deficit-hyperactivity disorder were found to be hypothyroid, and supplementing their thyroid levels was largely curative.

The mechanism whereby diminished thyroid function affects behavior is unclear. Hypothyroid patients have reduced cortisol clearance, and the constantly elevated levels of circulating cortisol mimic the condition of an animal in a constant state of stress, as well as suppressed TSH output and production of thyroid hormones. In humans and seemingly in dogs, mental function is impaired and the animal is likely to respond to stress in a stereotypical rather than a reasoned fashion. Chronic stress in humans has been implicated in the pathogenesis of affective disorders such as depression. Major depression has been shown in imaging studies to produce changes in neural activity or volume in areas of the brain which regulate aggressive and other behaviors. Dopamine and serotonin receptors have been clearly demonstrated to be involved in aggressive pathways in the CNS. Hypothyroid rats have increased turnover of serotonin and dopamine receptors, and an increased sensitivity of ambient neurotransmitter levels. In dogs with aberrant aggression, a large collaborative study at Tufts University has shown a favorable response to thyroid replacement therapy within the first week of treatment, whereas it took about three weeks to correct their metabolic deficit. Dramatic reversal of behavior with resumption of previous problems has occurred in some cases if only a single dose is missed. A similar pattern of aggression responsive to thyroid replacement has been reported in a horse.

Tables 1 and 2 summarize results of complete thyroid diagnostic profiling on 634 canine cases of aberrant behavior, compiled by the authors in collaboration with Drs. Nicholas Dodman, and Jean DeNapoli of Tufts University School of Veterinary Medicine, North Grafton, MA.

*Ninety percent (568 dogs) were purebreds and 10% were mixed breeds.

*There was no sex predilection found in this case cohort, whether or not the animals were intact or neutered.

*63% had thyroid dysfunction as judged by finding 3 or more abnormal results on the comprehensive thyroid profile

*The major categories of aberrant behavior were: aggression (40% of cases), seizures (30%), fearfulness (9%), and hyperactivity (7%); some dogs exhibited more than 1 of these behaviors.

*Thyroid dysfunction was found in 62% of the aggressive dogs, 77% of seizing dogs, 47% of fearful dogs, and 31% of hyperactive dogs.

*Outcomes of treatment intervention with standard twice daily doses of thyroid replacement were evaluated in 95 cases. Of these, 58 dogs had greater than 50% improvement in their behavior as judged by a predefined 6-point subjective scale (34 were improved >75%), and another 23 dogs had >25 but <50% improvement. Only 10 dogs experienced no appreciable change, and 2 dogs had a worsening of their behavior. When compared to 20 cases of dominance aggression treated with conventional behavioral or other habit modification over the same time period, only 11 dogs improved >25% and of the remaining 9 cases, 3 failed to improve and 3 were euthanized or placed in another home. These initial results are so promising that complete thyroid diagnostic profiling and treatment with thyroid supplement, where indicated, is warranted for all cases presenting with aberrant behavior.

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Table 1. Canine Aberrant Behavior *

Total No. Cases	Purebreds	Mixed Breeds	Thyroid Dysfunction	Euthyroid
634	568	66	401	233

* Mean Age, 3.7 years (Range 0.5-12 years). Median Age, 2.5 years.

Table 2. Most Commonly Represented Breeds with Thyroid Dysfunction and Aberrant Behavior*

Breed	Thyroid Dysfunction 401/634 (63%)	Aggression 251/634 (40%)	Seizures 189/634(30%)	Fearful 55/634 (9%)	Hyperactive 42/634 (7%)
Golden Retriever	50/73	12/16	22/30	4/6	1/6
German Shepherd	34/53	10/22	14/16	3/7	2/2
Akita	27/38	24/33	0/1	0	0/2
Labrador Retriever	8/30	6/11	12/16	2/15	0/3
Shetland Sheepdog	14/25	3/6	2/3	2/4	3/3
Collie	8/9	0	7/7	0	0
English Setter	4/6	1/1	0	1/3	1/2
Other Purebreds	217/334	89/135	72/93	10/15	5/16
Mixed Breeds	39/66	11/27	16/23	4/5	1/8
Totals	401/634 63%	156/251 (62%)	145/189 (77%)	25/55 (47%)	13/42 (31%)

* Some dogs had more than 1 abnormal behavior. Numerator = Thyroid Dysfunction. Denominator - Aberrant behavior

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