



Aggression and Hypothyroidism in Dogs, an-Overview

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Abstract

One of the most often diagnosed endocrine disorder in middle-aged dogs is hypothyroidism. The clinicopathological aspects of the disease are well known and established by the scientific community. For over 20 years the relationship between aggression and hypothyroidism has been reported in the literature. Still the link remains speculative due to lack of overhaul scientific data. The aim of this study is to present data from the literature relating to the association of aggression with hypothyroidism in dogs.

Keywords: Hypothyroidism; Aggression; Dog

Introduction

Canine hypothyroidism is one of the frequently diagnosed endocrine disorders in dogs. Data regarding the prevalence of the disease are inaccurate due to reliably diagnosing hypothyroidism and the variable prevalence found in different breeds [1]. Almost all the naturally occurring hypothyroidism in adult dogs is featured to irreversible destruction of the thyroid glands due to lymphocytic thyroiditis or idiopathic atrophy [1]. As the disease progresses and more thyroid tissue disappears, T4 and free T4 levels decline progressively, and at some point, clinical signs of thyroid hormone deficiency develop. Hypothyroidism is particularly common endocrine disorder in medium to larger purebred middle aged dogs [2]. Most often, the clinical manifestation of hypothyroidism is a combination of dermatological and metabolic signs. Most commonly described dermatological signs of hypothyroidism are: hair thinning or alopecia, poor hair quality, skin hyperpigmentation, pyoderma or seborrhea. The metabolic signs include: lethargy, obesity and weight gain, exercise intolerance, cold intolerance [3].

There are several hematological and serum biochemistry alterations that usually occur in hypothyroid dogs. Mild, normochromic, normocytic anemia is usually noted in these patients, due to decreased production of erythropoietin and lack of a direct effect of thyroid hormones on bone marrow. Cholesterol level is usually increased, with or without hypertriglyceridemia, because thyroid hormones are essential for metabolism of lipids (including synthesis, mobilization and degradation). Diagnosis of hypothyroidism is made based on clinical and laboratory findings together with assessment of thyroid function throughout basal thyroid hormone analyses, endogenous canine TSH or the presence of TgAA (all tests have significant differences in diagnostic performance) [2]. Individual dogs vary in the serum levels of thyroid hormones at which clinical signs of hypothyroidism develop, as well as the distribution of affected systems and the intensity of clinical signs [4]. Regarding behavioral changes in dogs with hypothyroidism, mental dullness and lethargy are most frequently reported [5]. Some dogs suffering from hypothyroidism show aggressive behavior similar to dominance- or fear-related aggression [6].

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Specific behavior changes, mostly present in dogs with hypothyroidism include: aggression, cold intolerance, decreased libido, exercise intolerance, lethargy or mental dullness, prolonged anestrus and weight gain or obesity. However, many of these behavioral signs are nonspecific, discrete and owners find it difficult to intemperate, or might also be used as one of the presenting signs for canine cognitive dysfunction, pain and concomitant diseases. Sometimes aggression might be the only sign, so hypothyroidism induced aggression might be considered as a specific type of aggression. The affected dog has been behaving normally, but over a period of time becomes increasingly aggressive [7].

It is established that thyroid hormones can affect the concentrations of serotonin and prolactin in blood and different brain regions [8,9]. Several studies with measurement of serotonin concentrations in blood or cerebrospinal fluid, functional brain imaging or by using drugs influencing serotonergic neurotransmission revealed involvement of the serotonergic system in dogs with aggression [10,11]. Prolactin also has an effect on neuroendocrine and behavioral adaptations. Thyrotropin-releasing hormone (TRH) stimulates PRL gene expression and PRL release. Aggression in dogs with high prolactin levels has mostly been associated with false pregnancy in dogs, but there are no studies about the PRL concentrations in other aggressive dogs [12,13].

Some newer research in humans and rats revealed objective evidence that brain structure and function are altered in hypothyroid patients, presenting with decreased hippocampal volume, cerebral blood flow and function globally, and in regions that mediate attention, working memory, and motor speed. Some of these alterations were absent after six months of treatment with thyroid hormone supplementation [14]. These kind of studies unfortunately are not conducted in hypothyroid dogs.

Though hypothyroidism has been linked with aggression over the years, there is no strong proof in the literature. Increased irritability and unprovoked aggression towards animals and people, which improved with combined levothyroxine and behavioral treatment, is reported by several authors [7,15,16]. But still the diagnosis of hypothyroid aggression can be challenging, due to the lack of specific tests for these type of aggression and there is no specific behavioral pattern of expression.

One randomized placebo-controlled study described a weak effect of thyroid hormone supplementation in owner-directed aggressive dogs with borderline thyroid hormone

levels. The authors recommend tepidity in treatment with thyroid hormones in these patients, because thyroid supplementation might cause some changes in behavior even in euthyroid patients, and thus behavior changes in association with thyroid supplementation should not be interpreted as evidence of disease [17].

Also, other case-controlled and cross-sectional studies failed to show abnormalities in several thyroid analytes in dogs with behavioral and aggression-related problems [18,19]. The study of Hrovat A. et al 2019, used profound standardized owner-completed online questionnaire and failed to demonstrate behavioral changes in 20 hypothyroid dogs with thyroid supplementation monitored for a 6-month period. They also didn't find any changes in serotonin and plasma prolactin concentrations in these patients [20].

In the study of Schreuder B, et al. [21] decreasing (but not completely disappeared) aggression in 4 hypothyroid dogs 8 months after introduction of thyroid supplementation treatment was reported. Other, studies reported that some owner related aggressive hypothyroid dogs showed a marked response to thyroid hormonal replacement, while others, had only partial reduction of aggression, recommending a full thyroid panel in the work-up of most, if not all, behavioral cases [15,22,23].

Different type of approach was presented in the study of Radosta LA, et al. [19] comparing canine thyroid panel (TT4, fT4 (ED), T4AA, TT3, fT3, T3AA, TSH, and TgAA) in group of familial aggressive and non-aggressive dogs. They found that the only difference between the two groups was the serum T4AA, which was significantly higher in the aggressive group than in the control group, but the T4AA concentrations were still in the reference range in both groups. An elevation of T4AA can be an indicator of underlying thyroiditis, but this parameter alone is not sufficient for a diagnosis of hypothyroidism and a high normal concentration cannot be used as indication for treatment with thyroid hormones [24].

From the analyzed studies, several conclusions can be elicited. Studies in veterinary and human medicine, although inconsistent, have documented an influence of thyroid function in mental disorders and individual response to thyroid hormone supplementation. Thyroid hormone has effects on the normal functioning of the serotonin-dopamine pathway. There are not enough strong data and further studies are warranted regarding association of low thyroid hormones and canine aggression. Standardized evaluation of the behavior and neurohormonal status of dogs treated with thyroid hormones as well as well-designed study on a larger group of patients with appropriate follow up and behavioral assessment is necessary.

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