
Hypothyroidism in dogs should be diagnosed by integrating the history, clinical symptoms and thyroid hormone assay. Affected dogs have a slow onset of decreased activity, cold intolerance, and skin changes of thickening and mild hyperpigmentation. The hair coat becomes dry and coarse, and alopecia develops in friction areas. The non-specific clinico-pathological changes of a mild anaemia and hypercholesterolaemia do not occur consistently. The easiest and best documented thyroid hormone assay is serum thyroxine (T4). The most accurate diagnosis is made using either the thyrotropin (TSH) stimulation test or thyroid gland biopsy. The condition is controlled by thyroxine replacement therapy at a dose rate of 30-50 mcg/kg/day in 2 divided doses, for the life of the dog.

HISTORY AND CLINICAL SYMPTOMS

Hypothyroidism in dogs is an endocrine deficiency that has a low incidence. It is frequently diagnosed solely on the basis of weight gain. However, this finding, in the absence of other symptoms, is insufficient to warrant such a conclusion. The condition has an insidious onset. Typically it manifests clinically with some of the following signs: decreased activity, leading to lethargy; increased weight with a normal appetite; intolerance to cold; skin thickening and mild hyperpigmentation; and a dry, coarse hair coat with alopecia. The alopecia is most marked on the friction areas of the chest, flanks and thighs. The skin and hair coat changes are bilaterally symmetrical, and non-pruritic (Figs. 1, 2, 3 & 4). Bradycardia is an inconsistent finding.

The most common differential diagnoses for generalized weight gain leading to obesity, which, which must be considered are overfeeding, underexercising and agonadism (neutering). Other uncommon causes of obesity include hyperadrenocorticism, hyperinsulinism, the hypothalamic syndrome, and dystrophia adipogenitalis.

CLINICAL PATHOLOGY

Haematological examination and the serum cholesterol level are frequently used to support a diagnosis of hypothyroidism. Unfortunately, the findings are neither consistent, nor specific. A mild nonregenerative normochromic anaemia occurs in 25-30% of hypothyroid animals. Other causes of this type of anaemia include myelophthisic (e.g. primary or secondary bone marrow neoplasia), aplastic, (e.g. ehrlichiosis, oestrogen toxicity), chronic infections, neoplasia, and uraemia. Generally, these conditions result in weight loss, and other clinical symptoms such as depression, haemorrhage, vomiting, and so on.

Table 1: NORMAL CHOLESTEROL VALUES ACCEPTED BY OUR LABORATORY

<table>
<thead>
<tr>
<th>Animal and diet</th>
<th>mg/dl</th>
<th>mmol/l</th>
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<tbody>
<tr>
<td>Dogs, low fat diet</td>
<td>130–210</td>
<td>3,4-5,4</td>
</tr>
<tr>
<td>(dog pellets, meal, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dogs, moderate fat diet (dog pellets</td>
<td>150–250</td>
<td>3,6-6,5</td>
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<td>and table scraps, or fresh meat)</td>
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<td></td>
</tr>
<tr>
<td>Cats, low or moderate fat diet (cat</td>
<td>95–130</td>
<td>2,4-3,4</td>
</tr>
<tr>
<td>pellets, or fish, or fresh meat)</td>
<td></td>
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Serum cholesterol levels are dependent upon the animal fat content of the diet eaten by the animal (Table 1). Serum cholesterol levels are only elevated in 60% of hypothyroid dogs. Hypercholesterolaemia is not specific for thyroid hormone deficiency, but also occurs with diets high in animal fat, hyperadrenocorticism, diabetes mellitus, the nephrotic syndrome, and some liver disorders. Rare diseases that cause hypercholeste-
Thyroaeemia include idiopathic hyperlipidaemia, biliary obstruction, and von Gierke's disease (Type 1 glycogen storage disease).

**SPECIFIC THYROID GLAND TESTS**

As there appears to be considerable confusion over the various assays for thyroid hormone levels, each test is described, and its application is delineated.

*Protein bound iodine* (PBI) is not an accurate indicator of thyroxine levels in the dog due to (a) considerable non-thyroxine iodine bound to plasma proteins, (b) the high concentrations of inorganic iodides in canine serum and, (c) the frequent use of medications that contain iodine. All these factors falsely elevate the PBI reading. PBI has now been replaced by tests that more accurately assay serum thyroxine.

*Serum thyroxine* or T4 may be assayed by competitive protein binding (CPB) or by radio-immunoassay (RIA). These assay techniques measure the total bound and unbound or active) T4 present in the patient's serum. These T4 tests have been shown to be quite sensitive in detecting changes in circulating T4 levels in experimentally produced hypothyroidism in the dog, i.e. simple or uncomplicated hypothyroidism (Table 2).

<table>
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<tr>
<th>Table 2: SERUM THYROXINE RANGES FOR NORMAL AND HYPOTHYROID DOGS</th>
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<tr>
<td></td>
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<tr>
<td>------------------</td>
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<tr>
<td>Dogs, normal</td>
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<tr>
<td>Dogs, hypothyroid</td>
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Note that the T4 ranges from normal and hypothyroid dogs overlap.

*Serum triiodothyronine* of T3 may be measured by a radio-isotope column retention test. In man, values in hypothyroid patients greatly overlap those found in euthyroid subjects. Values for dogs and cats, by this technique, are lacking. A new method which gives satisfactory results utilizes a specific labelled anti-T3 antibody. This gives an absolute result which is measured in nanograms. The normal range for the dog is 48–154 ng/dl. Only rarely does the T3 result give any additional information over that obtained by the T4 results. However this test is very expensive due to the cost of “Thytopar”*, and the necessity of assaying pre- and post-injection T4 levels.

*Thyrotropin hormone response* test or TSH stimulation is the most accurate indicator of thyroid gland function, as it provides results that can be readily interpreted. The test is performed by collecting a blood sample for serum, injection 10 IU thyrotropin intravenously between 08h00 and 09h00, and then collecting another blood sample 8 h later. In normal dogs, the T4 concentration rises to above 4.0 µg/dl, while in hypothyroid animals the level remains below 1.0 µg/dl. However, this test is very expensive due to the cost of “Thytopar”*, and the necessity of assaying pre- and post-injection T4 levels.

*Thyrotropin (TSH) assay* is the most sensitive and accurate method of diagnosing hypothyroidism in humans. Unfortunately, the assay of canine thyrotropin, by utilizing the human thyrotropin RIA test, is unreliable. This test in dogs must await the purification of canine thyrotropin and the development of antibodies.

*Thyroid gland biopsy* can yield useful results if the caudal quarter of one of the lobes is removed for histological examination. This is a simple surgical procedure without significant risk to the patient. Needle biopsy is not satisfactory as the sample size is too small to allow

**Fig. 3.** A mixed breed dog, female, 10 years old, that had gained weight over the previous 4 months. Her hair coat was rough, and there was alopecia and hyperpigmentation in the flank area.

**Fig. 4.** Dachshund cross dog, male, 5 years old, suffering from bilateral symmetrical, non-pruritic alopecia of the axillae, ventral abdomen, thighs and tail.

*Thyroid stimulating hormone. Armour Pharmaceutical.
an accurate evaluation of the functional state of the thyroid glands. Primary hypothyroidism is characterized by thyroid gland atrophy due to loss of follicular cells. Secondary hypothyroidism (due to TSH deficiency) is clearly distinguished by distended follicles due to colloid accumulation, the absence of peripheral vacuoles in the colloid and by the flattened follicular epithelium.

Practical diagnosis of hypothyroidism should be based on history, clinical symptoms, T4 CPB or T4 RIA test, and response to thyroid hormone replacement therapy (see below). Complete blood counts and serum cholesterol should be utilized only to monitor the response to treatment.

### TREATMENT

Hypothyroidism in animals cannot be treated and cured: it can only be controlled by the life-long daily administration of thyroid hormone replacement therapy. The 3 proprietary preparations which contain an accurate and consistent level of thyroid hormones are:

- **“Tertroxin”** (Glaxo-Allenby): 5 mcg and 20 mcg tablets containing triiodothyronine (T₃)
- **“Diotroxin”** (Glaxo-Allenby): 90 mcg thyroxine (T₄) and 10 mcg triiodothyronine (T₃) per tablet
- **“Eltroxin”** (Glaxo-Allenby): 0.05 and 0.1 mg tablets (50 mcg and 100 mcg) containing thyroxine (T₄)

The replacement dose of thyroxine for the dog has previously been:

initially 10–20 mcg/kg/day after 2 weeks, increase to 20–30 mcg/kg/day maximum of 40 mcg/kg/day

Recently it has been demonstrated that the dosage of both T₄ and T₃ required to return hypothyroid dogs to normal are higher than expected, and are much higher than the amount required in humans. Accordingly, the recommended dosage rates in dogs now are:

(a) T₄: 12.8 mcg/kg/day in 4–6 divided doses “Tertroxin” one 20 mcg tablet per 1.5 kg per day.

(b) T₃ and T₄ combination: 32 mcg/kg/day of T₄, with 3.2 mcg/kg/day of T₃ in 2 divided doses “Diotroxin” one 100 mcg tablet per 3 kg per day.

(c) T₃: 32 mcg/kg/day in 2 divided doses “Eltroxin” one 100 mcg tablet per 3 kg per day.

It is known that the thyroid hormones in dogs have a rapid plasma clearance half-time as compared with humans. Thyroxine (T₄) should be administered twice daily while triiodothyronine (T₃) should be given 4–6 times a day. A clear clinical response should be seen within 6 weeks from the commencement of adequate replacement therapy.

### REFERENCES