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Clinical Article

CLINICO-DIAGNOSTIC STUDIES ON HYPOTHYROIDISM IN GERIATRIC DOGS

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SUMMARY

Eleven geriatric dogs of different breeds were presented with history of lethargy and dermatological problems. On the basis of clinical history, physical examination, laboratory tests including thyroid function tests, the dogs were diagnosed with hypothyroidism. Four dogs amongst these showed gall bladder mucocele on abdominal ultrasonography.

Keywords: Dermatology, Geriatric dogs, Hypothyroidism, Thyroid function tests

Hypothyroidism is the most commonly diagnosed endocrinopathy of dogs. Thyroid disorders are an important cause of morbidity in geriatric dogs and cats. The diagnosis of thyroid dysfunction is more difficult in older animals because of the impact of age, concurrent illness, and administered medications on serum concentrations of thyroid hormone (Scott-Moncrieff, 2012). As in other organ systems, normal ageing of the endocrine system is characterized by a progressive loss of reserve capacity, resulting in a decreased ability to adapt to changing environmental demands. This loss of homeostatic regulation reflects important alterations in hormonal synthesis, metabolism, and action, but since the functional reserve for endocrine organs is much greater than the resting level, clinical change is generally not evident except under severe stress conditions (Chastain *et al.*, 1983). Accurate diagnosis of the disease is based on the clinical signs, laboratory tests and response to therapy. There are three major categories of hypothyroidism based on the location along the hypothalamic-pituitary-thyroid gland axis responsible for decreased thyroid hormone circulation i.e. primary, secondary and tertiary hypothyroidism in which tertiary is uncommon in canines. The most common causes of hypothyroidism in geriatric dogs are lymphocytic thyroiditis and idiopathic thyroid atrophy. Both the second itions result in destruction of normal thyroid tissue and decreased circulation of thyroid hormones (Boari and Aste, 2003).

Eleven geriatric dogs presented with clinical signs of persistent alopecia (bilateral symmetrical alopecia and rat tailed appearance), exercise and cold intolerance and history of drastic weight gain were subjected to detailed clinical and laboratory examination. History and clinical signs were recorded in all the animals. Five ml of blood sample was collected from each of the eleven dogs for hematological and biochemical analysis. Two ml of blood was transferred into K3 EDTA vacutainer for hematological analysis and 3 ml blood was transferred to clot activated vacutainer for separation of serum sample.

Hematological parameters like hemoglobin, packed cell volume, total erythrocyte count, total leukocyte count and differential leukocyte count were performed by manual method as described by Jain (1993). Serum samples were used for thyroid function tests including TSH, total T4 and free T4 by direct solid phase enzyme immune assay using ERBA thyrokit according to the manufacturer's instructions. Serum total protein, albumin, ALT, ALP, glucose, total bilirubin, BUN, creatinine, sodium and calcium were estimated using Erba Mannheim ready to use kits. The dogs with hypothyroidism were also subjected to electrocardiography (BPL-Cardiart) as per the procedure cited by Tilley (1992).

The ECG was recorded using the standard bipolar limb leads at 25 mm/second speed and the abnormalities interpreted. Ten apparently healthy geriatric dogs brought for routine general checkup and vaccination were selected as control group for comparison and to evaluate various parameters under study.

All the eleven dogs were presented with a history of persisting dermatological problems (bilateral symmetrical alopecia, rat tail appearance, thinning of hair coat and hyper-pigmentation of skin) and exercise and cold intolerance. Five dogs were Pomeranian, 2 were Labrador retriever, 2 were Dachshund and 2 were Mongrel. Out of 11 dogs, 5 were male and 6 were female. On physical examination, dullness, non-pruritic bilateral alopecia, thickening of skin and obesity were observed. Haematological parameters observed are presented in the Table 1. There was highly significant difference in haemoglobin, PCV, TEC, neutrophils (%) and lymphocytes (%) values between dogs with hypothyroidism and normal dogs ($p<0.01$). Also, TLC differed between the two groups at $p<0.05$, whereas, monocytes and eosinophils (%) did not vary significantly. The anemia could be due to a decreased

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Table1

Haematological parameters of dogs (Mean±SE)

Parameter	Control (n=10)	Hypothyroidism (n=11)
Haemoglobin (Hb) (g/dl)	12.72±0.15	10.52±0.14**
Packed cell volume (PCV) (%)	36.26±0.81	32.71±0.34**
Total erythrocyte count (TEC) (106/µl)	7.18±0.10	5.40±0.11**
Total leucocyte count (TLC) (103/µl)	12.69±0.31	17.85±0.99*
Differential leucocytic count (DLC)		
Neutrophils (%)	71.30±1.42	83.07±1.35**
Lymphocyte (%)	24.10±0.43	12.25±1.05**
Monocyte (%)	2.10±0.67	1.05±0.29^{NS}
Eosinophil (%)	1.50±0.52	0.71±0.21^{NS}

* -Significant at p≤0.05; **- Significant at p≤0.01; NS - Non-significant

stimulation of erythropoiesis by erythropoietin and thyroid hormones (Finora and Greco, 2007).

Serum biochemical parameters are presented in Table 2. There was no significant difference in total protein, albumin, total bilirubin, BUN, creatinine and sodium levels as compared to control group. There was highly significant difference in levels of ALT and ALP when compared to control group ($p<0.01$). Mild hyperkalemia (5.69±0.16) and hyperglycemia (106.19) were also noticed.

The TSH level was 11.45±1.28 ng/ml (reference range: 6 ng/ml). The concentration of total T4 was 0.71±0.34 mg/dl (reference range: 0.8-1.5 mg/dl) and the concentration of free T4 was 0.34±0.11 ng/dl (reference range: 0.5-0.8 ng/dl) (Nelson and Couto, 2014). Thyroid function tests indicated severe hypothyroidism by significantly low level of total T4 and free T4 and elevated TSH levels.

Table 2

Serum biochemical parameters of dogs (Mean±SE)

Parameter	Control (n=10)	Hypothyroidism (n=11)
Total protein (g/dl)	5.81±0.13	5.36±0.15^{NS}
Albumin (g/dl)	2.32±0.10	2.29±0.11^{NS}
ALT (U/L)	70.04±2.61	81.66±2.12**
ALP (U/L)	71.97±3.71	75.75±4.11**
Total bilirubin (mg/dl)	0.22±0.04	0.25±0.06^{NS}
BUN (mg/dl)	21.56±1.54	23.05±1.25^{NS}
Creatinine (mg/dl)	0.94±0.12	0.8±0.15^{NS}
Sodium (mmol/L)	143.77±1.05	141.36±4.01^{NS}
Potassium (mmol/L)	4.37±0.09	5.69±0.16*
Glucose (mg/dl)	97.59±4.81	106.42±1.90**

* -Significant at p≤0.05; **- Significant at p≤0.01; NS - Non-significant

Fig. 1. Bilateral patchy alopecia and rat tail appearance in geriatric dogs with hypothyroidism

Fig. 2. Hyper-pigmentation of skin in hypothyroid geriatric dog

In the present study, major clinical findings observed were dulless, hypothermia and affections of skin including non-pruritic dermatitis, patchy bilateral alopecia, thickening and hyper-pigmentation of skin and rat tail appearance (Fig. 1). Hypothermia is reportedly due to decreased ATP use and thus decreased oxygen consumption and decreased heat generation (Atkinson and Aubert, 2004; Blois et al., 2008). Thyroid hormones are extremely important in maintenance of normal cutaneous function, and dermatologic abnormalities are reported in 60% to 80% of hypothyroid dogs. Signs of decreased metabolic rate in conjunction with dermatologic abnormalities should increase the clinical suspicion of hypothyroidism. Thyroid hormones are thought to be necessary for initiation of the anagen phase of hair growth; therefore, hypothyroidism may lead to alopecia or failure of hair regrowth after clipping. Alopecia is usually bilaterally symmetric and is first evident in areas of wear, such as the lateral trunk, ventral thorax, and tail. The head and extremities tend to be spared. The hair may be brittle and easily epilated, the coat may appear dull or faded in color, and loss of undercoat or primary guard hairs may result in a coarse appearance or a puppy-like hair coat (Scott-Moncrieff, 2007). The major electrocardiographic changes noticed in ECG of hypothyroid dogs included bradycardia, arrhythmias, decreased myocardial contractility (low 'r' wave). These changes are usually mild but may become significant in the face of aggressive fluid therapy or anesthesia. Cardiovascular changes are usually

reversible with long-term treatment for hypothyroidism (David, 2001).

CONCLUSION

Hypothyroidism is common in geriatric dogs. It is important to use a combination of clinical assessment with routine and specific endocrine tests in order to make a definitive diagnosis.

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