ISSN: 1220-3173; E-ISSN: 2457-7618

ARTHERIAL HYPERTENSION IN DOGS WITH HYPOTHYROIDISM. CASE STUDY

HIPERTENSIUNE ARTERIALĂ LA CÂINI CU HIPOTIROIDIE. STUDIU DE CAZ

C.G. TAREK[1), 2), *)], Samantha FARES[1)], Alina ANTON[2)], G. SOLCAN[2)*)]

ABSTRACT

Hypothyroidism in dogs is characterized by the reduction of basal metabolism, cortical inhibition, obesity, bilateral symmetric alopecia, bradycardia and hypotension. In four dogs with hypothyroidism we found hypertension. Evaluation of the blood pressure was performed by the Doppler method. The diagnosis of hypothyroidism was confirmed by free T4, TSH and cholesterol dosing. Three of the four patients developed concomitantly other conditions: diabetes mellitus, hyperadrenocorticism and chronic renal failure, respectively. The hypercholesterolemia found in all the four patients (over 425 mg / dL) can justify the tendency in atherosclerosis and arterial hypertension.

Key words: artherial hypertension, dog, hypothyroidism, hypercholesterolemia

REZUMAT

Hipotiroidia la câini se caracterizează prin reducerea metabolismului bazal, inhibiție corticală, obezitate, alopecie simetrică bilaterală, bradicardie și hipotensiune arterială. La patru câini cu hipotiroidie am constatat hipertensiune arterială. Evaluarea tensiuni arteriale s-a efectuat prin metoda Doppler. Diagnosticul de hipotiroidie s-a confirmat prin dozarea T4 liber, TSH și colesterolemiei. La trei din cei patru pacienți evoluau concomitent alte afecțiuni precum: diabet zaharat, hiperadrenocorticism și respectiv insuficiență renală cronică. Hipercolesterolemia constatată la toți cei 4 pacienți (peste 425 mg/dL) poate justifica tendința la ateroscleroză și hipertensiune arterială.

Cuvinte cheie: hipertensiune arterială, câine, hipotiroidie, hipercolesterolemie

Primary hypothyroidism, caused by an intrinsic pathology of the thyroid gland, is the most common type of hypothyroidism in dogs. It is usually caused by lymphocytic thyroiditis or thyroid atrophy. Dysfunction at any level of the hypothalamic-pituitary-thyroid axis may occur. The association between artherial hypertension and hypothyroidism is not fully understood, cathecolamines and their receptors in the cardiovascular system are involved, as well as atherosclerosis and obesity associated with hypothyroidism. Dogs with hypothyroidism are often lethargic and have poor exercise tolerance, mental retardation, bradycardia, increased weight without increased food intake, cold intolerance and hypothermia. Dermatological signs often predominate: we can note bilateral alopecia, a dry and dull coat, myxedema, hyperpigmentation, comedones, seborrhea and recurrent pyoderma.

Unsterilized females may exhibit abnormal sex cycles and males lack libido and infertility.

Sometimes we observe constipation and corneal lipidosis (9). Some authors also mention the tendency to hypotension (6). It should be noted that the classical clinical signs are in some cases associated, while in others, we observe only one sign.

MATERIALS AND METHODS

From an estimate of 150 canine patients examined, four (2.7%) had hyperthyroidism associated with arterial hypotension. The blood pressure measurements were performed indirectly using Doppler method which has the advantages of being the most used in practice, easy to handle, inexpensive and whose reliability and reproducibility of measurements are already confirmed and demonstrated (Vmed VetDop 2TM). In contrast, this method tends to underestimate arterial pressure (AP) by 10 to 15 mmHg (2, 3, 10). In addition, with this method, diastolic AP is very difficult to measure, but as diastolic hypertension is usually associated with systolic hypertension, one can only measure systolic AP. The dogs were placed in lateral or sternal recumbency. We have chosen a cuff adapted to the size of the animal (30 to 40% of the circumference of the limb) and which was placed at mid-

1) Lebanese University, Faculty of Agriculture & Veterinary Medicine, Beirut, Lebanon
2) University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad", Iași, Romania
*) *Corresponding authors: chadi.tarek@hotmail.com; gsolcan@uaiasi.ro*

radius midway between the elbow and the carp. The left forelimb was generally used, with the exception of hospitalized patients in whom the selected limb was free of intravenous catheters. A coupling gel was applied to the ultrasonic sensor placed opposite the radial artery. Finally, several successive measurements (generally five) were made, the mean of which was then calculated while discarding the highest and the lowest values. In order to minimize the white coat effect as much as possible, the AP measurements were performed in a calm environment, with the least amount of manipulation, preferably at the beginning of the consultation. Earphones were used because the noise generated by Doppler is a stressor for dogs. The animals were conscious throughout the procedure and no tranquilizer was used.

Blood biochemical assays and formula counting. Blood was collected from the jugular vein after mopping and alcohol disinfection of the puncture area. A serum tube with a 3 ml gel separator was filled. The dry tube was kept for 10 minutes, then centrifuged for 10 minutes. The serum was then removed with a pipette and placed in the special tube of the Fuji DRI-CHEM NX500i biochemistry analyzer to separately determine urea, creatinine, pyruvic glutamic transaminase, alkaline phosphatase and glucose.

The hormone dosages were monitored by the radioimmunoassay method. The samples sent were in the form of serum and the transport was carried out under the conditions specified by the laboratories. Different hormones have been evaluated: cortisol, free T4, TSH, to confirm a suspected hormonal disease in a dog based on clinical signs and / or blood tests, or to search for the cause of hypertension in any dog whose previous tests were inconclusive. Excluding clinical signs, hypercholesterolemia caused suspicion of hypothyroidism. For the evaluation of the thyroid, two samples were collected at a 90 min difference.

RESULTS AND DISCUSSIONS

2.7% of dogs in the group (4/150) suffered from hypothyroidism.

The four dogs were reported by owners to be lethargic and intolerant to exercise. Weight gain without increased food intake was reported in two of the dogs. On clinical examination, various dermatological conditions were noted in the four dogs, bradycardia was noted in three dogs and hypothermia in two dogs (Fig. 1 - a, b).

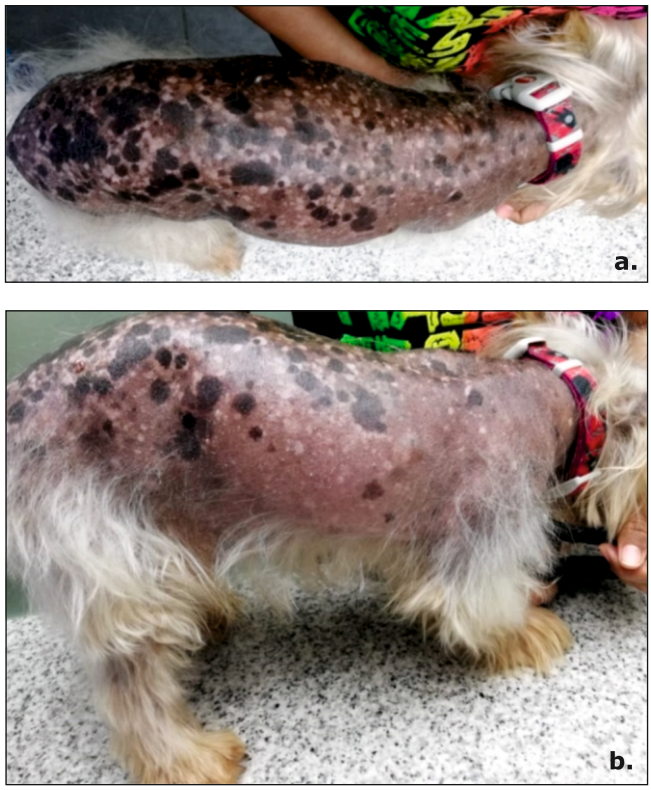

Fig. 1. Dog with hypothyroidism showing bilateral alopecia and hyperpigmentation of the skin.
a. dorsal view; **b**. lateral view

Hypothyroidism was suspected in 9 dogs. The values of free T4 and TSH confirmed the presence of hypothyroidism in only four dogs. Cholesterol values are well above normal in all four dogs (Table.1).

Systolic arterial pressure (SAP)

A single dog with hypothyroidism has a systolic arterial pressure of 220 mmHg, but the same dog suffers from hyperadrenocorticism.

The Pearson Chi-square test shows that the dependence of the variables considered is statistically insignificant ($p = 0.239 > 0.05$). Thus, it is reasonable to suggest that the relationship between hypertension and hypothyroidism is weak. Interpretation of blood pressure values was performed according to Table 2.

Before any review of the different tests available, the following points should be noted: (a) Hypothyroidism is a clinical diagnosis, not a laboratory diagnosis; laboratory tests are used to confirm clinical suspicion, but cannot be used individually. (b) None of the existing endocrine tests are 100% accurate.

The influence of commonly used drugs and non-thyroid diseases on the thyroid and thyroid test results should not be underestimated.

Medications and a number of clinically similar non-

Table 1

Biochemical blood results of 4 dogs with hypothyroidism

Age (year)	Sex	PAS (mmHg)	FreeT4 (t0) (pmol/L)	FreeT4 (t0+90) (pmol/L)	TSH (µg/L)	CHOl mg/dl	Concurrent diseases
9	M	150	6.4	-	0.64	>450	Diabetes mellitus
12	F	220	9	8	_	425	Hyperadrenocorticism+ cardiac disease
8	F	150	8	-	0.8	>450	Chronic renal failure
13	M	155	8	7		430	-

Table 2

Classification of blood pressure (1, 7)

Risk category	Risk of damage to the target organs	Systolic arterial pressure (mmHg)	Diastolic arterial pressure (mmHg)
I	Minim	<150	<95
II	Slight	150-159	95-99
III	Moderate	160-179	100-119
IV	Severe	≥180	≥120

thyroid diseases consistently, produce thyroid function test results that can be easily interpreted as hypothyroidism. Hypercholesterolemia is observed in nearly 70% of hypothyroid dogs. Biliary excretion of cholesterol is reduced during hypothyroidism, thus, to avoid hepatic overload by cholesterol, the plasma concentrations of these lipoproteins increase and cause hypercholesterolemia. Approximately 30% of hypothyroid dogs have mild normocytic, normochromic,non-regenerative anaemia that is a physiological response to lower basal metabolism. A slight to moderate increase in ALAT, ASAT and PAL liver enzymes can be observed.

Most used hypothyroidism screening tests in practice. Thyroid ultrasound allows for the evaluation of the structure, echogenicity, homogeneity, size of the lobes of the gland (4).

Total T4 assay. Total T4 is generally lower than normal in dogs with hypothyroidism. In most studies, less than 5% of hypothyroid dogs have normal values.

The presence of circulating T4 autoantibodies (T4 AAs) may interfere with actual total T4 measurements using most commercial methodologies. Anti-T4 antibodies artificially increase the total concentration of T4 measured. Anti-thyroid hormone antibodies develop in a subset of dogs with lymphocytic thyroiditis. These dogs produce antibodies against the thyroglobulin molecule, corresponding to T4 (T4AA) or T3 (T3AA). Their presence can lead to normal or even high false total T4 values (8).

Thyroid-stimulating hormone (TSH) assay. In primary hypothyroidism, negative feedback is insufficient to limit the secretion of TSH and in dogs with primary hypothyroidism, an increase in circulating concentrations of cTSH is expected.

Free T4 assay. Free T4 is the metabolically active fraction of T4 and represents the hormonal fraction available for tissue uptake. Theoretically, its measurement should provide the most accurate evaluation of the thyroid. The method used to measure free T4 concentrations is important. Using this technique, measuring free T4 is a two-step procedure. The test lasts longer (24 to 48 hours) and therefore costs more than conventional methods.

1. The first step involves dialysis of the sample through a T4-binding protein-tight membrane and anti-T4 antibodies. Only the free hormone can cross the membrane in the dialysate.

2. The second step is to subject the dialysate to an ultra-sensitive T4 radioimmunoassay. A small proportion of hypothyroid dogs maintain free T4 values in the reference range. Other conditions such as hyperparathyroidism and others may cause secondary hypertension in the dog and all should be removed to confirm the idiopathic nature of hypertension (5).

CONCLUSIONS

Arterial hypertension is reported in four dogs with hypothyroidism. Of these, 3 also suffered from other

conditions: diabetes mellitus, hyperadrenocorticism and chronic renal failure respectively. We believe that hypercholesterolemia found in all the four patients, predisposing them to atherosclerosis, could explain secondary arterial hypertension.

REFERENCES

1. *Brown S., Atkins C., Bagley R., Carr A., Cowgill L., Davidson M., Egner B., Elliott J., Henik R., Labato M., Littman M., Polzin D., Ross L., Snyder P., Stepien R.,* (2007), Guidelines for the Identification, Evaluation, and Management of Systemic Hypertension in Dogs and Cats. JVIM, 21(3):542-558
2. *Sulter S.A.*, (2005), Contribution à l'étude de l'hypertension artérielle chez 72 chats âgés. Ecole Nationale Vétérinaire de Lyon, thèse 84, Lyon, France, 13-44
3. *Codreanu M.D., Cucos A.C., Codreanu I., Negreanu R., Nae R., Constantinescu R.,* (2016), Ultrasonographic examination of thyroid and parathyroid glands in dogs and cats, Revista Romana de Medicina Veterinara, 26(2):11-16
4. *Constantinescu R., Cucos A.C., Vlagioiu, C., Codreanu, M.D.,* (2017), Ultrasound evaluation of common carotid artertyartery blood flow in dogs, Revista Romana de Medicina Veterinara, 27(1):9-15
5. *Smith F., Tilley L.M., Oyama M., Sleeper M.M.*, (2015), Manual of Canine and Feline Cardiology, 5th Edition, (Ed.) Saunders Elsevier, Philadelphia, Pennsylvania, USA, 239-274
6. *Falca C., Mircean M., Mot T., Braslasu M.C., Giurgiu G., Vlagioiu C., Pop C., Papuc I., Solcan G., Vulpe., V.*, (2011), Medicina interna a animalelor, vol. 1-2, (Ed.) Eurostampa, Timisoara, Romania,
7. *Jepson R.E.*, (2011), Feline systemic hypertension: Classification and pathogenesis. Journal of Feline Medicine & Surgery, 13(1):25-34
8. *Nelson R.W., Couto G.*, (2014), Small animal internal medicine, 5th Edition, (Ed.). Mosby Elsevier, St. Louis, Missouri, USA,760-772
9. *Schaer M.*, (2006), Medecine cliniique des chiens et chats, (Ed.) Masson, Paris, 368-376
10. *Stepien R.L.*, (2011), Feline systemic hypertension Diagnosis and Management, Journal of feline medicine and surgery, 13:35-43.