



UNUSUAL COMBINATION OF HYPERTHYROIDISM AND CAROTID SINUS HYPERSENSITIVITY IN YOUNG CAT

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ABSTRACT

Case report described 18 months therapy strategy and management of unusual combination two rare diagnoses in the young cat. A 13-month-old neutered female domestic shorthair cat was presented with a 5-month history of repeated episodic weakness, dyspnoea, flaccidity, fainting, deteriorating over time to collapses with breathlessness and unconsciousness. Simultaneously polydipsia with polyuria and polyphagia with voluminous droppings and decreased interest in contact were observed. Hypersensitivity of carotid sinus and hyperthyroidism were documented. A permanent transjugular pacemaker was placed to prevent further life-threatening syncope, followed by subtotal thyroidectomy after 2 weeks. During 15 months until follow-up, there were neither recurrences of syncope nor signs of hyperthyroidism. Recently, the cat is completely without medication. Our observation indicates that hyperthyroidism can occur also in a young cat and that hypertensive carotid sinus can be successfully resolved by VVI pacemaker implantation.

List of abbreviations

FH = Feline hyperthyroidism, **HCS** = hypersensitive carotid sinus, **HD** = high definition, **PBDE** = polybrominated diphenyl ethers, **PM** = pacemaker, **SVT** = supraventricular tachycardia, **TE** = thyroidectomy

INTRODUCTION

Feline hyperthyroidism (FH) in young cats is extremely rare [1-3]. The same statement applies to hypersensitive carotid sinus (HCS) in young cats. Submitted report describes the successful therapy this unique combination of diseases with permanent pacemaker (PM) and partial thyroidectomy (TE).

CASE HISTORY: 13-month-old neutered female short-haired European cat, suffering from a 5-month history of

repeated progressively deteriorating collapses was presented.

The cat had only been in the possession of the owner, who lives in an apartment. The cat had been vaccinated twice, wormed at regular intervals, and neutered without complications at 7 months of age. She was playful, cheerful and active, and she had occasional access to controlled outdoor activity in forest and gardens. She was fed with a commercial diet and commercial supplements. Her favourite flavours of food were salmon,



other sea food and veal in both dry and canned foods. The apartment had been recently renovated and the furniture was new, mainly from wooden chipboard (as a possible source of polybrominated diphenyl ethers = PBDE).

During the last 5 months prior to presentation the owners had noticed that during increased activity the cat would stop in sternal recumbence, gasping for breath with immediate onset of weakness, falling and flaccidity, sometimes culminating in unconsciousness. Attacks were preceded by panting and vocalization. The situation had reached its worst within the last 2 weeks, as the breathlessness was beginning sooner (after just 3–5 steps) and it was associated with passivity and lethargy. The episodes lasted approximately 20-30 seconds; they had become more violent and had occurred even after no activity. Finally, for 10 seconds breathing stopped completely. Simultaneously, the owners observed polydipsia with polyuria, polyphagia with voluminous droppings and decreased interest in contact.

At the time of first presentation (July 2010) at our clinic the cat was in a poor physical condition and had matted thick hair. Physical examination revealed temperature of 39.5 °C, irregular heart rate of 150 bpm without murmurs, breathing of 35/min with vesicular sounds, body weight of 3.1 kg. Blood pressure was 165/95 mmHg when measured by HD-oscillometry on the tail artery. Palpation revealed global loss of musculature. All other physical examination findings were within normal limits.

Electrocardiographic features included basal sinus rhythm of 151 bpm (Fig 1A).

Echocardiography demonstrated only slightly subnormal values of fractional shortening and left ventricular diastolic diameter, while left ventricular systolic diameter was slightly supranormal. Neither congenital abnormality nor dilated or hypertrophic cardiomyopathy symptoms were found.

On the X-ray examination of the thorax conducted in the latero-lateral and dorso-ventral view was not detected the abnormalities.

Laboratory testing repeatedly confirmed elevated T₄ concentration as a marker of FH accompanied by non-specific biochemistry changes (hypocholesterolemia, hypercalcemia) and haematological changes (erythrocytosis, leukopenia with neutropenia).

Carotid sinus massage: Trying to reproduce symptoms by carotid sinus massage, only the attempt to streamline the head induced a syncope with subsequent wheezing, caused by sinus bradycardia of 72 bpm (Fig 1B) with syncope changing the body position to lateral recumbence (second half of Fig 1B), followed by accelerated idioventricular rhythm (Fig 1C) progressing back to slow sinus rhythm (Fig 1D). Non-invasive blood pressure measurement was not possible because of too-short duration of the syncope; invasive measurement was not indicated.

Based on these findings, the diagnosis was made of HCS in cardioinhibitory form in combination with FH.

Increasing frequency of syncopal episodes necessitated that we implant a pacemaker (PM). The young age of the cat persuaded us to carry out a thyroidectomy to avoid lifelong thyreostatic medication. Therapy in two steps (PM implantation followed by TE after 2 weeks) was suggested and accepted by the owners.

General anaesthesia in both procedures was maintained with a combination of midazolam (Midazolam Chiesi 5 mg/ml, TORREX CHIESI PHARMA GmbH), medetomidine (Cepetor KH, CP-PHARMA), and ketamine (Narketan 10, Vetoquinol Biowet Sp. Z o.o.). With the patient secured in right lateral recumbence, access to the left external jugular vein was obtained and routine implantation standards were used (lead - Tendril 1788 ST 58, ST. JUDE MEDICAL) Implantation parameters were: R wave 10 mV, capture below 1V/0.4 ms, impedance 604 ohms. PM (Microny II SR, ST. JUDE MEDICAL) was located caudally from the scapula in the left lateral thorax. Final programming of the PM was: sensitivity from 2 mV, output capture 3.0 V/0.4 ms, base rate 100 bpm, no hysteresis, rate response function to 140 bpm. After introduction of the lead the procedure was complicated by supraventricular tachycardia (SVT) with left bundle branch blockade. When trying to over-pace through the lead, the SVT always spontaneously accelerated over the given frequency. Finally, the SVT was suppressed using IV a bolus of 15 mg amiodarone (Cordarone inj., SANOFI WINTHROP INDUSTRIE). To prevent next SVT, ZOK metoprolol (Betoloc ZOK 25 mg tbl., ASTRAZENECA UK Limited) 12,5 mg once daily was immediately after implantation started and terminated after 24 weeks.

For partial TE routine surgical standards were used. To avoid supplementation of thyroid hormones, the left part of the gland about 3 mm in diameter in the right lobe was retained. (Fig. 2.) After TE temporarily calcium chloratum (magistra liter) and vitamin D3 (Kombisol D3 a.u.v., BIOFAKTORY) balanced according to serum calcium concentrations and clinical symptoms were started. This was slowly discontinued and with complete cessation after 24 weeks, when serum calcium and phosphate concentrations were consistently normal.

Follow-up:
The cat recovered from both surgeries without complications. Immediately after PM implantation, the symptoms of HCS (syncope and breathlessness) suddenly disappeared completely. Three days after TE polydipsia and polyuria dissolved, after 10 days body weight started to increase from the detected low point of 2.75 kg to 5.7 kg one month after TE (today it is at a constant 4.2-4.5 kg). Eighteen months after surgery, the owners reported that the cat had shown no further collapse and had been leading a full and normal active life without medication. Cardiac pacing is still active (Fig 1E).

After adipose tissue restitution, subcutaneous fat was sampled and elevated levels of the flame retardants PBDE 47 (2.82 µg/kg adipose tissue), PBDE 99 (1.19 µg/kg adipose tissue), and PBDE 183 (0.91 µg/kg adipose



tissue) in adipose tissue (normal range $<0.08 \mu\text{g}/\text{kg}$) were detected. Owners were advised to avoid the use of feed

with fish flavours as a possible risk factor for the advancement of FH.

Figure 1. Resting ECG immediately before carotid sinus massage, sternal recumbence, 151 bpm (A) significantly changed after massage of carotid sinus (B–D). Heart rate decreased to sinus bradycardia 72 bpm with syncope changing the body position to lateral recumbence (second half of B), followed by accelerated idioventricular rhythm (C) progressing back to slow sinus rhythm (D). Strip E shows control ECG 10 months after pacemaker implantation (with pacing spikes in the second half).

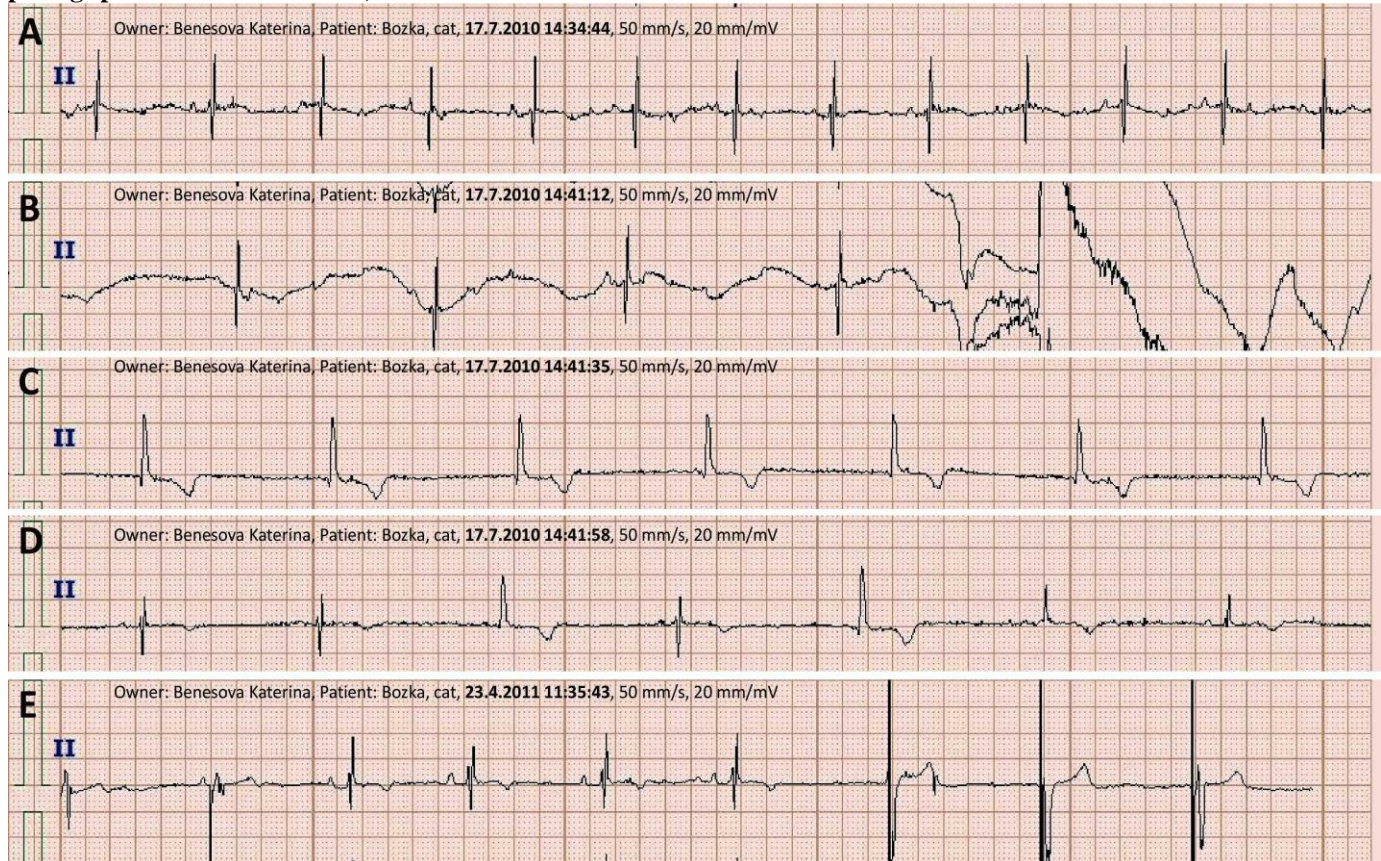


Figure 2. Definitive position of pacemaker and stimulation electrode.

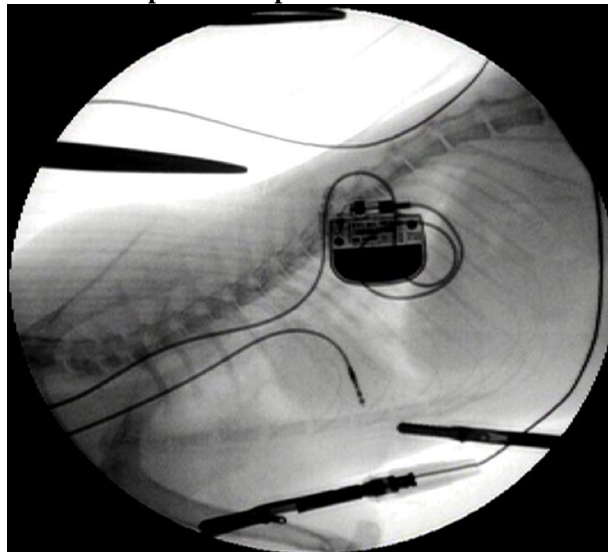
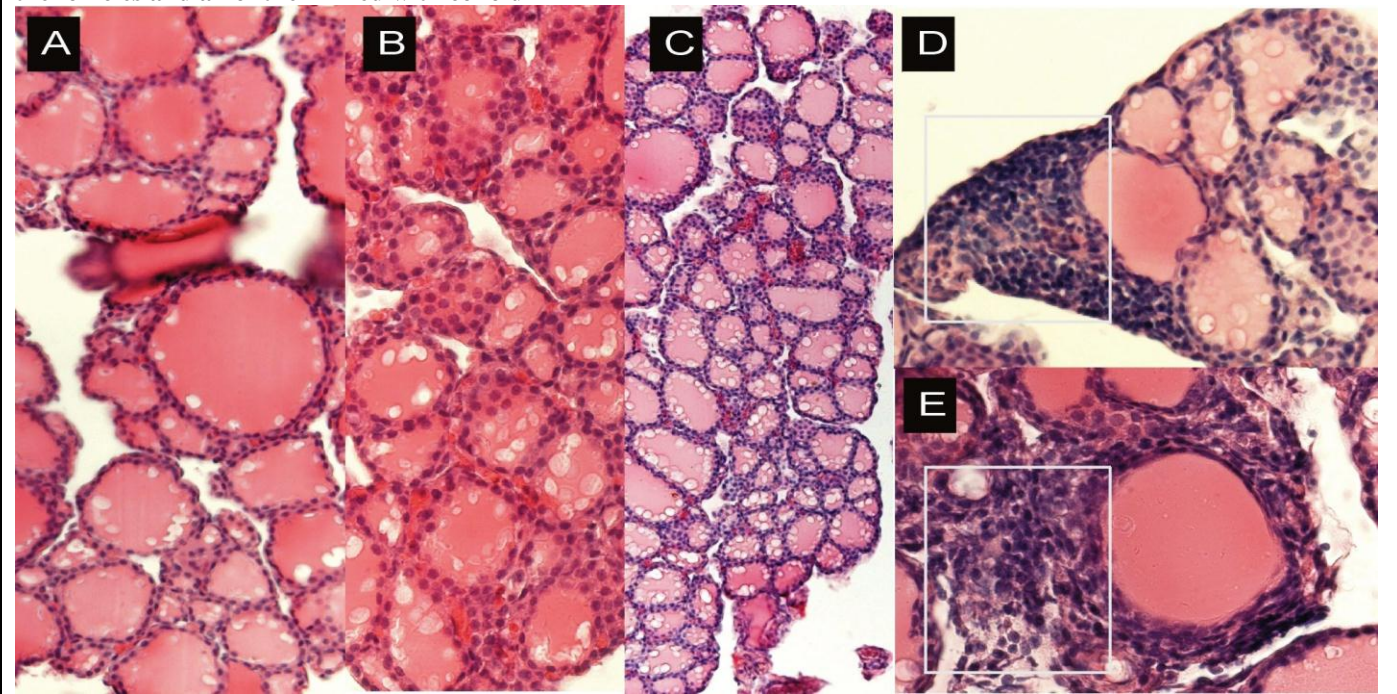


Figure 3. The histological samples of thyroid gland showed diffuse increase in the number of extremely large and small follicles, some of them with significant adsorption of colloid ("scalloping" at the periphery of colloid), an occurrence of lymphocyte aggregates and occasionally papilla-shaped protrusions of follicular cells projecting into the lumen of some large follicles. The appearance of the follicular cells was normal, with only a thin layer of connective tissue surrounded the follicles and all of them filled with colloid A



DISCUSSION AND CONCLUSION

The young (13 month-old) cat was diagnosed with two diseases that are extremely rare in this period of life – HCS and FH [1,2]. HCS with symptomatic bradycardia or syncope is not uncommon in humans, although it is not frequently reported. The clinical symptoms consist of sudden, short episodes of dizziness, fainting, seizures, or syncope as signs of insufficient blood flow to the brain. Recovery is usually very fast. Massage of the carotid sinus could lead to reproduction or partial reproduction of the symptoms, but the reproducibility is not obligatory for diagnosis. The diagnosis in humans is confirmed if the massage produces either more than 3 seconds of ventricular standstill or decrease in blood pressure (BP) by more than 50 mmHg [3]. Unfortunately there are no diagnostic criteria for animals. Although we did not observe complete ventricular standstill, decrease in heart rate of 50% was apparent and caused the same symptoms as did syncope in everyday life. Non-invasive HD oscillometric BP measurement is not possible in this short time period, because it requires 30–60 seconds. Even BP using Doppler technique takes a longer time than is available during the syncope. Therefore, while we diagnosed the cardioinhibitory form of HCS, we could not exclude the mixed form.

Cardio-inhibitory or mixed form can be resolved permanently only with cardiac pacing. Pacemaker therapy in cats is still not widely used (only trans-venous pacing in 9 cats) [4-9], but none was performed in a kitten or at early

“post pubertal age. For the PM, a pocket in the abdominal cavity between external and internal oblique muscles is mostly used. We used the smallest available pacemaker, which helped us to create a more advantageously placed pocket for the stimulator in the lateral thorax, and so far it works flawlessly with the described patient. While dual chamber mode (DDD) is the preferred stimulation mode in humans, placing two leads into a cat’s heart would be difficult and associated with more potential complications. Therefore, we chose a single chamber PM. As a base rate, we used the normal resting/sleeping heart rate for cats, 100 bpm, with no hysteresis, and we used a rate response function during physical activity to 140 bpm. The complications of pacing in cats are similar to those in humans – migration of the pulse generator, dislodgement or fracture of the lead, pulse generator under sensing, seroma in the PM pocket and chylous thoracic effusion.^{4,6} Feline hyperthyroidism was first described in 1979 [10] and with increased frequency since that time. It is now considered the most common endocrine disease of cats. FH develops in cats over 6 years old and is now considered to be epidemic in many countries [11]. With only one exception describing juvenile FH in an 8-month-old male cat,¹ there are no reports in the literature of FH in cats <4 years of age. Clinical signs including weight loss with polyphagia, polyuria with polydipsia, tachycardia, agitation, alopecia and, less often, vomiting, anorexia, heat intolerance and lethargy [12,13]. The diagnosis is

confirmed by the demonstration of increased circulating concentrations of T₄ or increased thyroidal radioisotope uptake, which is elevated in 90% of hyperthyroid cats [14]. The aetiology of FH in cats remains controversial. Increasing age, non-pure breed, use of a litter box, more than 50% wet food in the diet, a diet that included fish were identified as risk factors for the development of FH in the UK [18]. The role of widely used flame retardants PBDEs has been repeatedly examined. Prolonged PBDEs exposure in house dust [19] and/or canned food [20] may put cats at increased risk for developing FH. From this point of view, it is interesting that our cat had elevated levels of main PBDEs in newly developed (after TE) adipose tissue. Although their possible role in the pathogenesis of FH in presented young patient is not clear, we recommended the owners to omit salmon and fish flavours from canned cat food, as these may containing in particular the PBDE-47 congener that we found in the cat's tissue. It is not clear whether HCS is associated with hyperthyroidism or whether the two diseases exist

independently from one another. One case report discussed thyreotoxicosis as a possible cause for cardiovascular syncope [9], while two other studies reviewing 103 cats with FH [21] and examining cardiovascular manifestations of FH in 202 cats [22] did not report syncopal episodes, although conduction abnormalities (right and left bundle branch blocks, atrio-ventricular blocks, pre-excitation) can occur. Only one case report describes syncope treated with cardiac pacing together with FH [8]. In that case, however, the patient was 13 years old cat, on this age at which both diagnoses are common. Those authors did not express their view concerning any possible mutual relationship between the two diseases.

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