Case Report

Reversible Dilated Cardiomyopathy Due to Subclinical Hyperthyroidism

Kostantinos Tsarouhas, Ioannis Kafantaris, Athanasios Antonakopoulos, Spiridoula Vavetsi, Pavlos Pavlidis, Loizos L. Constantinou

2nd Department of Cardiology, "Amalia Fleming" General Hospital, Athens, Greece

Key words:
Heart failure, endocrinopathy

We present a patient without primary heart disease in whom subclinical hyperthyroidism was accompanied by manifestations of dilated cardiomyopathy, as evaluated by echocardiography, coronary angiography, and radionuclide ventriculography. His condition was reversed 6 months after conventional treatment (furosemide, carvedilol, angiotensin-converting-enzyme inhibitor and thiamazole administration). This patient represents an exceptional case, as overt congestive heart failure with left ventricular dilatation and depressed ventricular ejection fraction is not a common finding in patients with hyperthyroidism, let alone patients with subclinical hyperthyroidism and no underlying heart disease.

Manuscript received:
January 17, 2009;
Accepted:
July 26, 2009.

Address:
Loizos L. Constantinou

78 28th Octobriou St.
15341 Agia Paraskevi
Athens, Greece
e-mail:
loizoscon@yahoo.com

Subclinical thyroid dysfunction is known to involve the cardiovascular system.[1-3] Subclinical hyperthyroidism –characterized by normal levels of circulating free thyroxin (FT_4) and free triiodothyronin (FT_3), while thyroid stimulating hormone (TSH) concentrations are below normal– is associated with several cardiovascular pathological manifestations, such as increased heart rate, atrial arrhythmias,[4] increased left ventricular mass, marginal exercise performance, and increased risk for cardiovascular death. It has generally been accepted that thyrotoxicosis may be associated with high output heart failure in patients with heart disease, either symptomatic or not.[5-7] While hyperthyroidism has been proven to cause reversible or non-reversible dilated cardiomyopathy,[8,9] similar cases caused by subclinical hyperthyroidism have never been reported.

We present a patient with subclinical hyperthyroidism and reversible dilated cardiomyopathy with a normal mean heart rate.

Case presentation

A 38-year-old male was admitted to our hospital with increasing dyspnea and cough without fever. The symptoms had started three days prior to hospital admission. On admission, his temperature was 36.8°C, blood pressure 130/80 mmHg, pulse rate 130 /min and during chest auscultation an S3 gallop with a prolonged left ventricular heave were detected. The patient had a free medical history, but was classified as a heavy-smoker (18 cigarettes per day). He was not under any medication or other drugs.

The chest X-ray revealed cardiomegaly and signs of pulmonary edema. The electrocardiogram showed sinus tachycardia (heart rate 130 /min) with normal axis deviation and nonspecific ST-T wave abnormalities. On the initial echocardiogram, left ventricular dilatation was observed with an ejection fraction of 35%. The first laboratory findings were negative for acute myocardial ischemia (troponin T <0.01 ng/mL, CPK 47 U/L, SGOT 12 U/L, SGPT 17 U/L, LDH 362 U/L). Signs of heart failure responded promptly to furosemide,

angiotensin-converting enzyme inhibitors, carvedilol administration, and bed rest.

Thyroid function tests were consistent with subclinical hyperthyroidism (TSH 0.008 μIU/ml, FT_3 5.6 pmol/l, FT_4 18.2 pmol/l) and a thyroid scan showed a nodule of 2.04 cm diameter in the left side of the thyroid gland, which was not palpable during clinical examination.

The coronary angiogram was negative for atheromatous lesions, but the left ventricular ejection fraction was depressed. Antibodies for adenovirus, Coxsackie B_1-B_6, Toxo-IgG, Toxo-IgM were negative. Twenty-four hour Holter ECG monitoring revealed a mean heart rate of 85 /min (minimum 50, maximum 150) and a short period of supraventricular extrasystoles. Cardiac magnetic resonance imaging showed decreased systolic function and dilatation of the left ventricle with an ejection fraction of 36.4%. Findings of radionuclide ventriculography were consistent with the above (Figure 1). A diffuse reduction of left ventricular wall motion and an increased left ventricular end-diastolic volume were also found.

The patient left hospital with normal cardiac enzyme levels (troponin T <0.01 ng/mL, CPK 37 U/L, SGOT 13 U/L, SGPT 17 U/L, LDH 309 U/L) and under conventional therapy (furosemide, carvedilol, angiotensin-converting enzyme inhibitor, and thiamazole). Six months later, during re-evaluation, the patient was found to be euthyroid (TSH 0.75 μIU/ml, FT_3 4.2 pmol/l, FT_4 15.2 pmol/l), symptoms were relieved and the echo findings for left ventricular

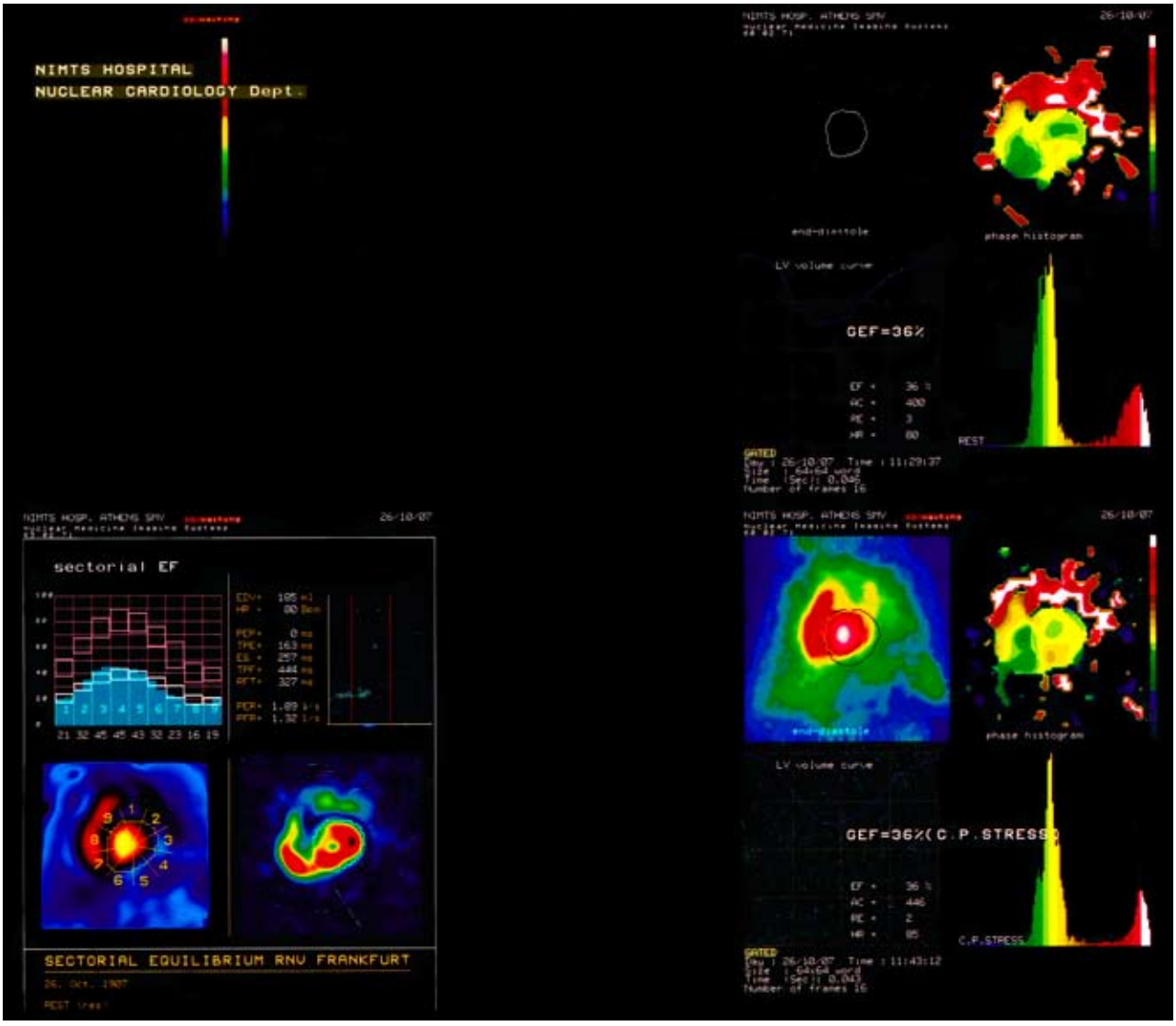

Figure 1. Radionuclide ventriculography at baseline.

Table 1. Echo findings on admission and six months later.

Echocardiographic parameters	Admission	6 months later
End-diastolic diameter (cm)	6.2	5.7
End-systolic diameter (cm)	5.1	4.5
Shortening fraction (%)	17.6	23.0
Ejection fraction (%)	36.4	50.0

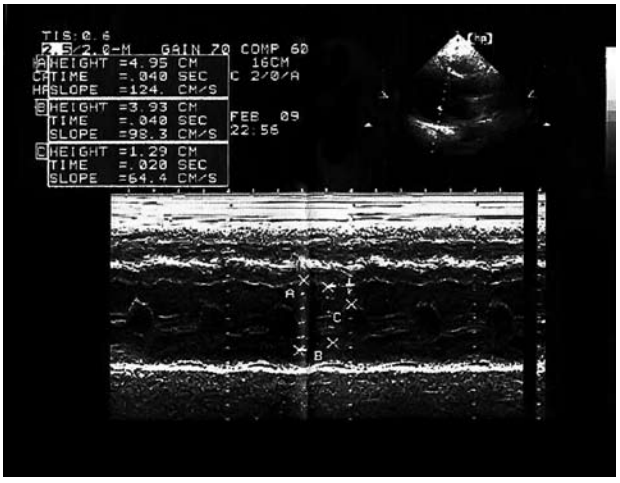

Figure 2. Echocardiographic findings at 18 months' follow up.

function were drastically improved (Table 1). They remained so even 18 months later (Figure 2).

Discussion

Subclinical hyperthyroidism, characterized by low TSH concentration and normal FT_4 and FT_3, may be caused by exogenous and endogenous factors. Our patient suffered from the endogenous form of subclinical hyperthyroidism without high pulse rate or atrial fibrillation. Only a few studies have evaluated the effect of the endogenous form on the heart.[10,11] The vast majority of studies in patients with subclinical hyperthyroidism showed an increased left ventricular mass, which was sometimes accompanied by impaired ventricular relaxation.[12] Nevertheless, left ventricular mass in these patients is not sufficiently high to be classified as left ventricular hypertrophy.[13] In our patient, dilatation of the left ventricle was observed with decreased systolic function, a diffuse reduction of left ventricular wall motion, and an increased left ventricular end-diastolic volume without hypertrophy of the left ventricle. Previous findings, reporting overt congestive heart failure with left ventricular dilatation and depressed left ventricular ejection fraction in a patient with thyrotoxicosis, are in agreement with the present case.[8] The fact that our patient had overt heart failure with a depressed left ventricular ejection fraction could lead to the suggestion that impaired contractility of the cardiac cells, for unknown reasons, is involved in the pathogenetic mechanism responsible.

In another experimental study, ventricular dysfunction in hyperthyroidism has been correlated with oxidative damage and antioxidant changes in protein expression.[14] In addition, evidence for the development of dilated cardiomyopathy with the administration of thyroxin in otherwise normal hearts has been confirmed in animal models and a pediatric population.[5] According to Siu et al, hyperthyroid patients with a lower serum T_4 level tended to develop left ventricular systolic dysfunction more than those with a higher T_4 level.[15] Subclinical hyperthyroidism has been studied by Faber et al, who found a significant reduction in cardiac output in six elderly women due to multinodal disease after treatment with radioiodine, suggesting that from a hemodynamic point of view endogenous subclinical hyperthyroidism might be regarded as a mild form of hyperthyroidism.[16]

In conclusion, the current patient represents an exceptional case, as overt congestive heart failure with left ventricular dilatation and depressed ventricular ejection fraction is not a common finding in patients with hyperthyroidism, let alone patients with subclinical hyperthyroidism and no underlying heart disease.

Acknowledgments

The authors would like to express their special thanks to cardiologist Georgios Kolios, personal attending physician of the patient of the study, for his kind provision of the echocardiographic images at 18 months' follow up.

References

1. Amidi M, Leon DF, DeGroot WJ, Kroetz FW, Leonard JJ. Effect of the thyroid state on myocardial contractility and ventricular ejection rate in man. Circulation. 1968; 38: 229-239.
2. Polikar R, Burger AG, Scherrer U, Nicod P. The thyroid and the heart. Circulation. 1993; 87: 1435-1441.
3. Klein I, Ojamaa K. Thyroid hormone and the cardiovascular system: from theory to practice. J Clin Endocrinol Metab. 1994; 78: 1026-1027.
4. Vardas PE, Mavrakis HE. Atrial fibrillation: a symptom treated as a disease? Hellenic J Cardiol. 2006; 47: 191-193.
5. Williams GH, Braunwald E. Endocrine and nutritional disorders and heart disease. In: Braunwald E, editor. Heart Disease. Philadelphia: WB Saunders; 1992. p.1830-1834.
6. Forfar JC, Muir AL, Sawers SA, Toft AD. Abnormal left ven-

tricular function in hyperthyroidism: evidence for a possible reversible cardiomyopathy. N Engl J Med. 1982; 307: 1165-1170.
7. Panagoulis C, Halapas A, Chariatis E, Driva P, Matsakas E. Hyperthyroidism and the heart. Hellenic J Cardiol. 2008; 49: 169-175.
8. Bauerlein EJ, Chakko CS, Kessler KM. Reversible dilated cardiomyopathy due to thyrotoxicosis. Am J Cardiol. 1992; 70: 132.
9. Ebisawa K, Ikeda U, Murata M, et al. Irreversible cardiomyopathy due to thyrotoxicosis. Cardiology. 1994; 84: 274-277.
10. Sgarbi JA, Villaca F, Scandiuzzi S, et al. Improvement of cardiac effects of endogenous subclinical hyperthyroidism with methimazol treatment. J Endocrinol. 2000; 47(Suppl): 179.
11. Biondi B, Fazio S, Palmieri EA, et al. [Effects of chronic subclinical hyperthyroidism from levothyroxine on cardiac morphology and function]. Cardiologia. 1999; 44: 443-449. Italian.
12. Fazio S, Biondi B, Carella C, et al. Diastolic dysfunction in patients on thyroid-stimulating hormone suppressive therapy with levothyroxine: beneficial effect of beta-blockade. J Clin Endocrinol Metab. 1995; 80: 2222-2226.
13. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Prognostic implications of echocardiographically determined left ventricular mass in the Framingham Heart Study. N Engl J Med. 1990; 322: 1561-1566.
14. Araujo ASR, Ribeiro MFM, Enzveiler A, et al. Myocardial antioxidant enzyme activities and concentration and glutathione metabolism in experimental hyperthyroidism. Mol Cell Endocrinol. 2006; 249: 133-139.
15. Siu C-W, Yeung C-Y, Lau C-P, Kung AWC, Tse H-F. Incidence, clinical characteristics and outcome of congestive heart failure as the initial presentation in patients with primary hyperthyroidism. Heart. 2007; 93: 483-487.
16. Faber J, Wiinberg N, Schifter S, Mehlsen J. Haemodynamic changes following treatment of subclinical and overt hyperthyroidism. Eur J Endocrinol. 2001; 145: 391-396.