Coronary Vasospasm Associated with Hyperthyroidism

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Acute myocardial ischemia is a rare and possibly life-threatening manifestation of hyperthyroidism. We describe a 48-year-old woman with severe coronary vasospasm associated with hyperthyroidism. The patient presented with chest pain and increasing shortness of breath for several days. Acute non-ST elevation myocardial infarction was diagnosed. Coronary angiography revealed diffuse vasoconstriction which was relieved by intracoronary nitroglycerin. Subsequently, she was diagnosed with hyperthyroidism and treated with antithyroid therapy and an oral calcium channel blocker. After restoration of euthyroidism, she remained free of chest pain. Our report reminds readers that severe coronary spasm might be sometimes associated with simultaneous hyperthyroidism, especially in patients without risk factors of atherosclerosis.

Key Words: Acute myocardial infarction • Coronary vasospasm • Hyperthyroidism

INTRODUCTION

The cardiovascular system is very sensitive to thyroid hormone, and a wide spectrum of cardiac changes has been recognized in hyperthyroidism.1 Acute myocardial ischemia is a rare and possibly life-threatening manifestation of hyperthyroidism. However, in the absence of fixed coronary artery disease, hyperthyroidism is rarely associated with acute myocardial ischemia. Herein, we present an acute myocardial infarction case with normal coronary arteries, who also had simultaneous hyperthyroidism.

CASE REPORT

A 48-year-old woman presented to our emergency department with a two-day history of chest pain and increasing shortness of breath. The episodes of pain varied in length and were aggravated by exercise. On direct questioning, she did not have palpitation, body weight loss, heat intolerance, or resting tremor. She denied any history of cardiovascular disease and was premenopausal. She denied smoking, drinking alcohol or illicit drug use. Her family history was noncontributory. She was 154 cm tall and weighted of 62 Kg, yielding a body mass index of 26.1. On physical examination, she was alert and oriented, with no obvious distress. Her vital signs were as follows: blood pressure, 117/77 mmHg; pulse, 97 beats/min; respiration, 14 breaths/min; and temperature, 36.7 °C. Neck examination revealed no jugular venous distension but a palpable neck mass measuring about 3 × 4 centimeters. The mass which had existed for years was rubbery in consistency, non-tender and rather fixed. The patient had a normal S1, physiologically split S2, an S4 without S3, and Grade II/VI systolic murmur over the apex. Chest, abdomen and neurological examinations were unremarkable.

The initial electrocardiogram (Figure 1A) revealed sinus rhythm with depressed ST segments in leads I, II, III, aVF, V4, V5 and V6 that indicated the presence of
subendocardial myocardial ischemia. The serum cardiac biomarkers were elevated, with a creatine kinase of 1074 U/L, MB isoenzyme of 183 U/L, and cardiac troponin I of 7.07 ng/mL (normal < 0.11 ng/mL). The levels of these biomarkers suggested acute myocardial infarction. The complete blood count and basic serum chemistry revealed the following: white blood cell count, 8.53 × 10^9/uL (normal range: 3.6 × 10^9~9.6 × 10^9/uL); hemoglobin, 13.6 g/dL (normal range: 12~16 g/dL); platelets, 161 × 10^9/uL (normal range: 120~330/uL); sodium, 135 mEq/L (normal range: 135~147 mEq/L); potassium: 4.3 mEq/L (normal range: 3.7~5.2 mEq/L); magnesium: 2.1 mg/dL (normal range: 1.8~3.0 mg/dL); calcium: 9.1 mg/dL (normal range: 9.8~10.3 mg/dL). Echocardiography demonstrated left ventricular anterolateral wall hypokinesis with a left ventricular ejection fraction (LVEF) of 48%.

The patient was treated with standard antiischemic therapy, including aspirin, clopidrogel, intravenous unfractionated heparin, a beta-blocker and intravenous nitroglycerin. Since even after aggressive medical therapy, chest pain continued with unstable hemodynamics and

![Figure 1.](image)

(A) Electrocardiogram on admission shows ST-segment depression in leads I, II, III, aVF, V4, V5 and V6 and ST-segment elevation in lead aVR. (B) Complete resolution of ST-segment deviation after correction of hyperthyroidism.
persistent ischemic ST-segment changes on electrocardiogram, we decided to perform early coronary angiography. Prior to catheterization, we did not take the possibility of hyperthyroidism into account because at presentation, there were no symptoms (such as body weight loss, palpitation, tremor or heat intolerance) suggestive of hyperthyroidism, although a goiter was found. Coronary angiography was performed on the next day and showed diffuse, intense narrowing of the left main, left anterior descending and left circumflex coronary arteries (a ‘chilled tree’ appearance) (Figure 2A). After administration of intracoronary nitroglycerin, all of the patient’s coronary arteries dilated to a normal caliber (Figure 2B). The right coronary artery was normal without stenosis (Figure 2C).

Thereafter, hyperthyroidism was confirmed by a plasma TSH < 0.03 uIU/mL (normal range: 0.35 uIU/mL ~5.5 uIU/mL) and free T4 of 2.67 ng/dL (normal range: 0.7 ng/dL~1.8 ng/dL). Antimicrosomal antibodies were 1:102,400 (normal range: < 1:100), and TSH receptor antibodies were 57% (normal range: < 10%). We consulted an endocrinologist for evaluation. Tc-99m thyroid scan revealed multiple non-functioning “cold” areas interspersed between areas of increased activity “hot” lesions in the right side of the thyroid. There was heterogenous uptake over the left side of the thyroid. The findings were consistent with toxic multinodular goiter. Operation was suggested, but the patient refused. She was treated with methimazole 40 mg/day and diltiazem 180 mg/day. Over the next few days, the patient had an uneventful hospitalization course. She was discharged on methimazole 20 mg/day and diltiazem 180 mg/day. Three months after discharge, euthyroidism was achieved, with a plasma TSH of 3.48 uIU/mL and free T4 of 1.04 ng/dL. Since restoration of euthyroidism, the patient has remained free of chest pain and the electrocardiogram (Figure 1B) demonstrated complete resolution of ST-segment deviation.

DISCUSSION

We encountered a case of coronary spasm induced acute myocardial infarction with simultaneous hyperthyroidism. Coronary angiography revealed diffuse severe coronary artery narrowing that involved the left main, left anterior descending and left circumflex coronary arteries was relieved by intracoronary nitroglycerin injection. Furthermore, the patient’s chest pain subsided with resolution of ischemic ST segment changes on electrocardiogram after recovery of euthyroid status.

Cardiovascular symptoms are often the predominant clinical presentation of patients with hyperthyroidism. A subset of thyrotoxic patients can experience angina-like chest pain. Somerville et al. described thyrotoxic angina as the following: (1) the presence of angina at rest, (2) rapidly progressive angina, (3) cessation of angina with treatment of hyperthyroidism, and (4) the lack of typical clinical manifestations of hyperthyroidism upon presentation. Our case is unusual in that she had severe and diffuse spontaneous vasospasm of the left coronary arteries, no history of hyperthyroidism, and angiographic evidence of coronary spasm associated with acute myocardial infarction.

Moliterno et al. demonstrated that recurrent ST changes on ambulatory ECG monitoring were correlated with elevations of serum thyroxine levels. A study of 6923 subjects undergoing coronary angiography for evaluation of chest pain found a 5% incidence of coronary artery spasm. In a subgroup of females under 50 years old with documented coronary artery spasm, the incidence of hyperthyroidism was 29%. Most of the patients were premenopausal women without coronary risk...
factors. These subjects, like our case, presented with severe myocardial ischemia. It must be noted that coronary artery spasm associated with hyperthyroidism should be considered in young females presenting with ischemic chest pain without conventional coronary risk factors.

Hyperthyroidism results in systemic cardiovascular hemodynamic changes. Ho et al. studied vasomotor activity in hyperthyroidism patients and they demonstrated that endothelium-dependent flow-mediated vasodilation (FMD) was increased in the hyperthyroidism patients. In addition, it has been reported that peripheral vasodilatation and increases in preload and plasma volume are central to the increase in cardiac output. Thus, it is seemingly paradoxical that thyrotoxicosis might induce coronary spasm when the effect of thyroxine on peripheral circulation is vasodilatation. In vitro studies demonstrated enhanced contractility of vascular smooth muscle in response to vasoconstrictive agents such as catecholamines and 5-hydroxytryptamine under a thyrotoxic state. The hyperthyroid state is associated with enhanced sympatho-adrenal activity due to increased adrenergic receptor sensitivity and increased receptor numbers. Consequently, stimulation of sympathetic alpha-adrenergic receptors on coronary arteries leads to coronary vasospasm. It is likely that these mechanisms underlie the association of coronary spasm with hyperthyroidism. Myocardial infarction may occur if the coronary spasm is sustained for a sufficient duration.

In general, the prognosis for hyperthyroidism-associated coronary vasospasm is good. It has been reported that patients with coronary artery spasm associated with hyperthyroidism will have no more angina once they become euthyroid. Antithyroid drugs, including methimazole, carbimazole and propylthiouracil (PTU), remained cornerstones in the management of hyperthyroidism. The choice between the drugs has traditionally been a matter of personal preference. Chen et al. demonstrated that PTU produced endothelium-dependent vasodilatation through thyroid-independent and NO-mediated mechanisms. In our case, restoration of euthyroidism was achieved with methimazole. We chose methimazole because of its potency ratio of 10:1 as compared with propylthiouracil for more rapid improvement in serum concentration of thyroxine and triiodothyronine. In addition, we initiated diltiazem therapy due to a theoretical benefit of calcium antagonists on relief of coronary arterial spasm. Napoli et al. reported that a reasonable treatment approach might be to continue nitrates and/or calcium channel blockers for 6-12 months after a euthyroid status has been achieved. Our patient remained free of chest pain after restoration of euthyroidism and treatment with diltiazem.

We have described a case of hyperthyroidism with simultaneous coronary spasm-related acute myocardial infarction. This case report reminds us to be aware of the possibility that hyperthyroidism might be sometimes associated with coronary artery spasm, especially in young female patients without conventional coronary risk factors, although there is definitely no proof for this association.

REFERENCES