Severe Hypothyroidism, Coronary Artery Disease on CT Coronary Angiography and Hypoperfusion on Contrast Echocardiography

**Corresponding Author:**
Dr. Branimir Kanazirev,
Cardiology and Internal Medicine, Department of Medicine, Varna Medical University, 9000, Varna, Bulgaria

**Submitting Author:**
Dr. Branimir Kanazirev,
Cardiology and Internal Medicine, Department of Medicine, Varna Medical University, 9000, Varna, Bulgaria

**Article ID:** WMC003858
**Article Type:** Case Report
**Submitted on:** 25-Feb-2013, 10:38:50 AM GMT  **Published on:** 25-Feb-2013, 01:57:24 PM GMT
**Article URL:** [http://www.webmedcentral.com/article_view/3858](http://www.webmedcentral.com/article_view/3858)
**Subject Categories:** CARDIOLOGY
**Keywords:** Hypothyroidism, Coronary Artery Disease, Microvascular Coronary Artery Disease, CT Coronary Angiography, Contrast Echocardiography

**How to cite the article:** Kanazirev B. Severe Hypothyroidism, Coronary Artery Disease on CT Coronary Angiography and Hypoperfusion on Contrast Echocardiography. WebmedCentral CARDIOLOGY 2013;4(2):WMC003858

**Copyright:** This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC-BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Article Video:** [http://www.webmedcentral.com/article_video/3858](http://www.webmedcentral.com/article_video/3858)

**Source(s) of Funding:**
No special funding

**Competing Interests:**
No conflict of interests
Severe Hypothyroidism, Coronary Artery Disease on CT Coronary Angiography and Hypoperfusion on Contrast Echocardiography

Author(s): Kanazirev B

Abstract

Background: The association between overt hypothyroidism (HT) and coronary heart disease is well known. Even subclinical hypothyroidism independently increases the relative risk of coronary artery disease and myocardial infarction and reduces coronary flow reserve.

Methods and results: A patient with severe HP and typical angina on exertion is presented having multiple epicardial coronary artery disease on CT-assisted coronary arteriography and decreased and heterogeneous myocardial perfusion on contrast echocardiography secondary to both macro and microvascular coronary artery disease.

Conclusions: Hypothyroidism is an important clinical situation and a risk factor to be considered for coronary artery involvement.

Background

Hypothyroidism is an important risk factor for coronary artery disease and heart failure. Thyroid function determines independently the extent and severity of coronary artery disease and leads to increased number of major cardiovascular events and decreased survival (1,2,3). Even subclinical hypothyroidism independently increases the relative risk of coronary artery disease and myocardial infarction and reduces coronary flow reserve in the absence of epicardial coronary artery disease.(4). The evolving new techniques for coronary artery stenosis visualization and myocardial perfusion disturbances-CT-assisted coronary arteriography and contrast-enhanced echocardiography could be used as non-invasive tests for coronary artery status elucidation in patients with hypothyroidism.

Methods and results

A patient of 61 was admitted to the Department of Medicine after being treated for psychomotor agitation at Outpatient Psychiatry Department with signs and symptoms of severe hypothyroidism-cold and dry skin, facial puffiness, yellow discoloration of the skin, hoarse voice, hearing deficit, slow slurred speech and chest pain on mild exertion. BP was 160/100, HR-65 bpm, non-specific ST-T changes were evident on ECG and CPK-MB and troponin were normal. Thyroid stimulating hormone was elevated 85 mU/ml, so was cholesterol-8,9 mmol/l. Echocardiography showed normal LV volumes with preserved systolic and segmental motion and EF-54%, abnormal relaxation on diastolic transmitral flow, preserved myocardial velocities on TDI and mild pericardial effusion. Patient refused catheter-based selective coronary arteriography, so CT-assisted coronary angiography was performed.

A standard procedure with application of Levovist on CT Dual Source Siemens Definition Machine with test bolus and calculated amount of contrast was used. Reconstructed images were evaluated and coronary artery stenosis were measured using incorporated software.

Contrast echocardiography was performed as well this time for evaluation of myocardial perfusion using echo contrast agent SonoVue (Bracco). This second-generation ultrasound contrast agent of sulfur hexafluorid-containing microbubbles surrounded by a phospholipid shell and mean size and concentration of microbubbles of 2.5 µm and respectively 1 to 5·10^8·ml^-1. The procedure included reconstitution of 2.5 mg of the agent with normal saline to the final solution of 5 ml with infusion of reconstituted agent followed by 10 ml saline flash. Acoustic power and compression were maximized and gain settings were optimized at the onset of study and held constant throughout. Mechanical index was set at 1.6 for flash images and 0.1 for real-time images and contrast images were acquired in apical 4-chamber. Myocardial perfusion was judged qualitatively after the splash of high mechanical index for destruction of bubbles and the ensuing replenishment of myocardial tissue.

Results: Three-vessel proximal coronary artery disease was found with diffuse involvement of
coronary arteries. (Fig.1)

Contrast echocardiography has shown hyperechogenic myocardium especially of the septum with decreased systole-diastolic changes in myocardial echogeneity during non-contrast phase and non-homogeneous hypoperfusion of the apical and lateral segments of contrast echocardiography reflecting both increased fibrosis of myocardium and the presence of both macro and microvascular involvement of the myocardium (Fig 2).

The patient has refused on multiple occasions to undergo any kind of interventional procedure be it percutaneous coronary intervention or aorto-coronary bypass surgery operation.

DiScussion

It is well known that hypothyroidism is a risk factor for earlier and accelerated epicardial coronary atherosclerosis and reduced coronary artery flow reserve. In patients with clinically manifested coronary artery disease hypothyroidism is found more often and all-cause mortality and cardiovascular mortality are increased. Reduced coronary artery flow reserve is a hallmark of microvascular disease of the coronary arteries is found even in patients with subclinical HT (1,2,3,4)

Evidence from magnetic resonance imaging studies of subclinical hypothyroidism show significantly decreased cardiac preload and an increased afterload with a consequent reduction in stroke volume and cardiac output was found. Diffuse hypo-opacification of myocardium was mentioned and replacement therapy fully normalized the hemodynamic alterations. (5)

In some patients with severe hypothyroidism thyroxine replacement therapy precipitates or aggravates angina pectoris, whereas in other patients angina pectoris is ameliorated or even disappears. The reason for this paradox is unknown. It has been attributed either to reversible endocrine cardiomyopathy in the form of asymmetric septal hypertrophy (ASH) (9) or reversible anatomical narrowing of the coronary arteries. The results of a recent investigation, in which myocardial performance was surveyed by radionuclide ventriculography throughout early thyroxine replacement therapy in severe hypothyroidism, were compatible with the presence of reversible coronary dysfunction rather than of ASH.

Exercise and redistribution tomographic myocardial thallium-201 imaging (SPECT) was performed before thyroxine replacement therapy and repeated after 10 days and again after 2 months during therapy. In patients without coronary artery disease substantial regional perfusion defects were demonstrated after exercise that were normalized at rest or after thyroxine therapy. With restoration of euthyroidism, exercise and redistribution SPECT became normal in every patient. Determination of exact confidence limits reveals that the proportional incidence of myocardial perfusion defects in hypothyroidism, including myocardial ischemia, will at least be 22% with 95% probability. Despite the relatively low specificity of SPECT it seems pertinent to conclude that impaired myocardial perfusion as assessed by SPECT probably is due to reversible coronary dysfunction inherent to the hypothyroid state, and that this is not an infrequent manifestation of severe hypothyroidism.(6)

To study myocardial perfusion in primary hypothyroidism accompanied by cardiac pain patients were examined by using resting and stress 201TI myocardial scintigraphy. At rest all the patients showed impaired myocardial perfusion. A decrease in 201TI accumulation, which corresponded to the areas of impaired perfusion, was observed in 54% of segments. A severe impairment of myocardial 201TI washout was recorded in every patient. With exercise additional transient myocardial perfusion was found. (7)

Myocardial oxidative metabolism was measured by positron emission tomography with [11C] acetate in patients with hypothyroidism as well and cine magnetic resonance imaging was applied to determine left ventricular geometry. Compared to hormone replacement state, systemic vascular resistance and left ventricular mass were significantly higher in hypothyroidism. Ejection fraction and stroke work index were significantly lower. Despite an additional reduction of oxidative metabolism, the wall motion index was significantly lower, too. In summary, cardiac oxygen consumption is reduced in hypothyroidism. This reduction is associated with increased peripheral resistance and reduced contractility.

Estimates of cardiac work show that it is more severely suppressed than estimates of oxidative metabolism, suggesting decreased efficiency. These findings may provide an explanation for development or worsening of heart failure in hypothyroid patients with preexisting heart disease. Thus, noninvasive estimates of cardiac efficiency suggest that myocardial performance is less efficient in hypothyroidism(8).
Echocardiographic videodensity textural characteristics were also studied and was shown to be increased in overt and subclinical hypothyroidism due to increased tissue fibrosis and possible interstitial edema with accompanying decreased diastolic-systolic variation in videodensity. In recent papers a significant correlation among systo-diastolic changes detected by Color Doppler myocardial imaging and integrated backscatter with serum TSH levels were found. The cyclic variation index at the septum, the PWDTI S-peak wave and the systolic strain of septum were inversely related to the serum TSH levels.(10,11,12,13)

Conclusions

New echocardiographic techniques allow early detection of ultrastructural and regional functional systolic and diastolic abnormalities. Myocardial tissue characterization is important diagnostic clue in manifest hypothyroidism and contemporary techniques are evolving for evaluation of myocardial perfusion in hypothyroid patients

References

Illustrations

Illustration 1

LAD, Cx and RCA coronary artery involvement with high grade proximal stenoses
Disclaimer

This article has been downloaded from WebmedCentral. With our unique author driven post publication peer review, contents posted on this web portal do not undergo any prepublication peer or editorial review. It is completely the responsibility of the authors to ensure not only scientific and ethical standards of the manuscript but also its grammatical accuracy. Authors must ensure that they obtain all the necessary permissions before submitting any information that requires obtaining a consent or approval from a third party. Authors should also ensure not to submit any information which they do not have the copyright of or of which they have transferred the copyrights to a third party.

Contents on WebmedCentral are purely for biomedical researchers and scientists. They are not meant to cater to the needs of an individual patient. The web portal or any content(s) therein is neither designed to support, nor replace, the relationship that exists between a patient/site visitor and his/her physician. Your use of the WebmedCentral site and its contents is entirely at your own risk. We do not take any responsibility for any harm that you may suffer or inflict on a third person by following the contents of this website.