Myocardial Infarction in Graves' Disease without Coronary Artery Disease

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SUMMARY

A 45-year-old female without coronary risk factors showed a 20 kg decrease in body weight, hyperhidrosis, palpitations and dyspnea on exertion for 2 months, and nocturnal dyspnea for 1 month before admission. She did not notice chest pain indicative myocardial infarction or fever suggestive myocarditis. Graves' disease was confirmed by exophthalmos and elevated titers of T₃ and T₄ thyroid hormones. Cardiac catheterization studies demonstrated no significant coronary artery disease but showed akinesis of the anteroapical and apical walls which suggested myocardial infarction.

Thyroid hormone may directly influence myocardial oxygen supply and demand and, by some unknown mechanism, cause a critical imbalance in coronary circulation resulting in myocardial infarction.

Additional Indexing Words:

Myocardial infarction Graves' disease Normal coronary artery

CHEST pain in patients with thyrotoxicosis is not uncommon, the incidence being reported to be 0.5-20% (usually 10-12%) by Burstein et al.¹⁾ Although patients with ischemic heart disease complicating this disorder usually have associated pre-existing coronary arterial lesions, patients with angina pectoris²⁾ or myocardial infarction without coronary artery disease³⁾ have also been reported. The pathogenic mechanisms of such conditions have yet to be elucidated, but coronary vasospasm,⁴⁾ abnormal microcirculation⁵⁾ and thromboembolism⁶⁾ have been suggested as possible causative factors. Publications in English written before 1980 contain reports

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of only 28 cases of myocardial infarction complicating Graves' disease.^{1)-3),5)-8)} In this article, a patient with thyrotoxicosis complicated by asymptomatic myocardial infarction is described and the literature reviewed.

CASE REPORT

The patient was a 45-year-old female clerk with no relevant family

Fig. 1. Electrocardiogram taken on admission shows QS in V₄, poorly progressive R in V₁-V₃, and flat or inverted T in III and V₄-V₆.

Table I. Laboratory Findings

RBC	$531 \times 10^4/\text{mm}^3$	Fe	35 r/dl
WBC	$5300/\text{mm}^3$	TIBC	417 r/dl
Hb	9.1 g/dl	T3	280 mg/dl
Ht	32 %	T4	12.9 mcg/dl
TP	6.9 g/dl	TSH	1 U/dl
ZST	3.3 U	CRP	(—)
T-Bil	0.6 mg/dl	ESR	8/20
GOT	18 U	PTT	63 sec
GPT	18 U	PT	11.5 sec
LDH	312 U	TEG	
Al-P	3.8 U	γ	9'30''
Ch-Ease	0.94 ΔpH	$\gamma + \text{K}$	18'30''
CPK	6	ma	43.0
T-Chol	151 mg/dl	fa	33.5

antiviral antibody for Coxsackie B group: negative

history. She had been treated 2 years before for iron deficiency anemia due to hemorrhoidal bleeding. In April, 1977, she felt general malaise, and iron deficiency anemia was noted again at a community hospital. There were no electrocardiographic abnormalities at this time. A decrease in body weight, hyperhidrosis and palpitations with no identifiable cause were noted since June, but were left untreated. In July, dyspnea during exertion and nocturnal dyspnea developed, and she lost 20 kg in 3 months. Since the symptoms did not improve, she was admitted to our hospital in July, 1982. No coronary risk factors were present on admission.

She was mildly thin and in no acute distress. Blood pressure was 146/76 mmHg, and the pulse rate was 108 per minute and regular. Although mild diffuse enlargement of the thyroid glands were noted, there was no tenderness or palpable mass. Exophthalmos was observed but ocular movement was normal. A fine tremor was present in both hands. The patient was slightly anemic, and a Levine II systolic ejection murmur was heard over the whole precordium. The chest X-ray showed cardiac enlargement with a 54% CTR, but signs of heart failure were absent. Electrocardiograms showed a QS pattern in V_4 and poor progression of R waves in leads V_1 – V_3 (Fig. 1). Biochemical blood data indicated iron deficiency anemia and primary thyrotoxicosis (Table I). Cardiac catheterization and angiography were performed 8 weeks after admission upon normalization of the thyroid function by the administration of iron preparations and mercazole (30 mg/day). Cardiac catheterization revealed increased cardiac output due to anemia and thyrotoxicosis (Table II). Left ventriculogram showed akinesis in seg-

Table II. Cardiac Catheterization and Left Ventriculography

PAW	11	CO	8.8 l/min
PA	34/14-21	CI	6.1 l/min/m ²
RV	33/2	LVEDV	158 ml
RA	0	LVESV	90 ml
LV	134/14	LVEF	0.43
AO	138/64 $\overline{90}$ mmHg

Fig. 2. Left ventriculogram in right anterior oblique projection shows akinesis of anterolateral and apical segments. ED=end diastole; ES=end systole.

ments 2, 3, 4 and 6 and normokinesis in segments 1, 4, 5 and 7 (Fig. 2). Coronary angiography (Fig. 2) showed no lesions. An ergonovine loading test was not performed. The patient followed an uneventful course after discharge and was without chest pain or heart failure.

DISCUSSION

Hyperthyroidism may elevate the oxygen consumption of the heart by increasing each of the three principle determinants of myocardial oxygen requirement, that is, blood pressure, heart rate and contractile state. However, the disease may also be associated with such complications as heart failure,⁹⁾ atrioventricular block,¹⁰⁾ angina pectoris²⁾ and myocardial infarction.³⁾ Concurrence of thyrotoxicosis and myocardial infarction has been reported in 28 patients in Europe and America, but most of these patients had pre-existing coronary disorders. Only 7 patients,^{3),5)-8)} including ours, showed normal coronary arteries.

The possible causes of the abnormal left ventricle in this patient include myocardial infarction without coronary disease, myocarditis and thyrotoxic cardiomyopathy. Although the symptoms of acute viral myocarditis can vary widely among individuals, 60–80% of patients usually have fever. In about one-fourth of the patients, fever will be high and may persist for 2–3 weeks after the acute illness. Furthermore, chest pain, which is the second most common symptom, may be present in 67–72% of patients. In this case, there was no fever or chest pain in spite of a reexamination of the clinical history in detail. Although the possibility of viral myocarditis could not be excluded on the bases of the clinical course and viral antibody titer, we prefer coronary artery disease as the probable etiology in this patient. Although experimental viral myocarditis may even produce ventricular aneurysms,¹¹⁾ a left ventriculogram showed abnormalities only in the area supplied by the left anterior descending coronary artery, suggesting myocardial necrosis caused by global ischemia. As possible causes of myocardial infarction in patients with normal coronaries, coronary spasm,³⁾ thromboembolism with recanalization of the lumen,⁶⁾ abnormal platelet function¹²⁾ or abnormal microcirculation have been suggested. In this patient, however, there was no evidence of chest pain or abnormalities in the blood coagulation tests, and arrhythmias such as atrial fibrillation or embolism in other organs were absent.

Coronary spasm is considered today to be a possible cause of myocardial ischemia in thyrotoxicosis, and has been demonstrated in 2 patients with angina pectoris.^{4),13)} Yasue et al¹⁴⁾ suggested that imbalance of autonomic nerve activity may accelerate the coronary artery spasm. However, several experimental studies^{15),16)} showed that it is difficult for thyrotoxicosis alone to produce coronary artery spasm. Although the mechanisms of myocardial ischemia in patients with hyperthyroidism remain unclear, the presence of ischemic heart disease is not uncommon and we must be alert for this in the treatment of thyrotoxicosis.

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