Cardiac Disease Associated with Hyper- and Hypothyroidism: Report of Two Cases.

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Abstract

Acute cardiac complications of thyroid dysfunction present a diagnostic and management problem. Two cases recently encountered at a private hospital are described.

Case 1 A 66-year-old female had a history of acute myocardial infarction and pulmonary edema two years prior to the diagnosis of thyrotoxicosis. She was treated twice with an oral antithyroid agent and was rendered euthyorid. However, upon discontinuation of therapy, she not only developed thyrotoxicosis a third time, but also presented with acute pulmonary edema. Subsequently she was treated with I^{131}. Three months later she again presented with acute pulmonary edema, acute myocardial infarction and severe hypothyroidism.

Case 2 A 59-year-old female was discovered to have thyrotoxocosis during hospitalization for control of diabetes mellitus. Eighteen hours after treatment with I^{131}, she developed acute pulmonary edema which resolved within 12 hours of appropriate medical management.

Key words: *Hyperthyroidism, hypothyrodism, cardiac disease, acute pulmonary edema, thyroid storm.*

Thyroid dysfunctions, both hyper- and hypothyroidism may have cardiac manifestations. Acute pulmonary edema during the course of treatment of hyperthyroidism with I^{131} has been reported but is uncommon. Similarly, acute pulmonary edema with hypothyroidism is rare. In this report, two cases are presented with diagnostic and management problems. In evaluating the cardiac status of a patient with thyroid diseases, it is sometimes difficult to ascertain whether the cardiac disease is solely a complication of the thyroid dysfunction or whether there is underlying organic heart disease which is aggravated by thyroid disease.

Case 1 Mrs. H, a 66-year-old white female, was initially seen on 11/28/79 with an acute anteroseptal myocardial infarction and resultant pulmonary edema. She was hospitalized for one month and required aggressive diuresis, preload and afterload reduction therapy. She was apprently clinically euthyroid at that time (no laboratory measurement of thyroid function was performed during this admission). The patient was subsequently discharged on digoxin, furosemide, hydralazine, and nitrates.

Follow-up included an M-mode echocardiogram on 5/80, which showed normal left ventricular size with an akinetic septum and apex.

On a follow-up visit to her cardiologist on 3/81, she was suspected to be clinically hyperthyroid and was therefore referred to an endocrinologist. Physical examination at that time showed a resting sinus tachycardia of 100 beats/minute and hyperreflexia. Neither lid-lag nor a palpable thyroid nodule were noted. The patient denied any history of thyroid disease, family history of same, or previous thyroid medication. She had, however, taken "iodine drops" for some unexplained reason in her youth. The patient's thyroid status and therapy are summarized in Figure 1. A T4 at that time was 11.7 with a T3RU of 38. The patient was started on prophylthiouracil (PTU) 100mg/day.

Frequent follow-up showed the patient gradually becoming euthyroid (with increased PTU dosage). The PTU was discontinued after 8 months, of treatment. However, the patient again became clinically hyperthyroid and was restarted on PTU. She refused treatment with radioactive iodine. PTU therapy was again discontinued one year later, as the patient became euthyroid. A followup T4 several months later was 16. This again necessitated PTU treatment which the patient shortly thereafter discontinued on

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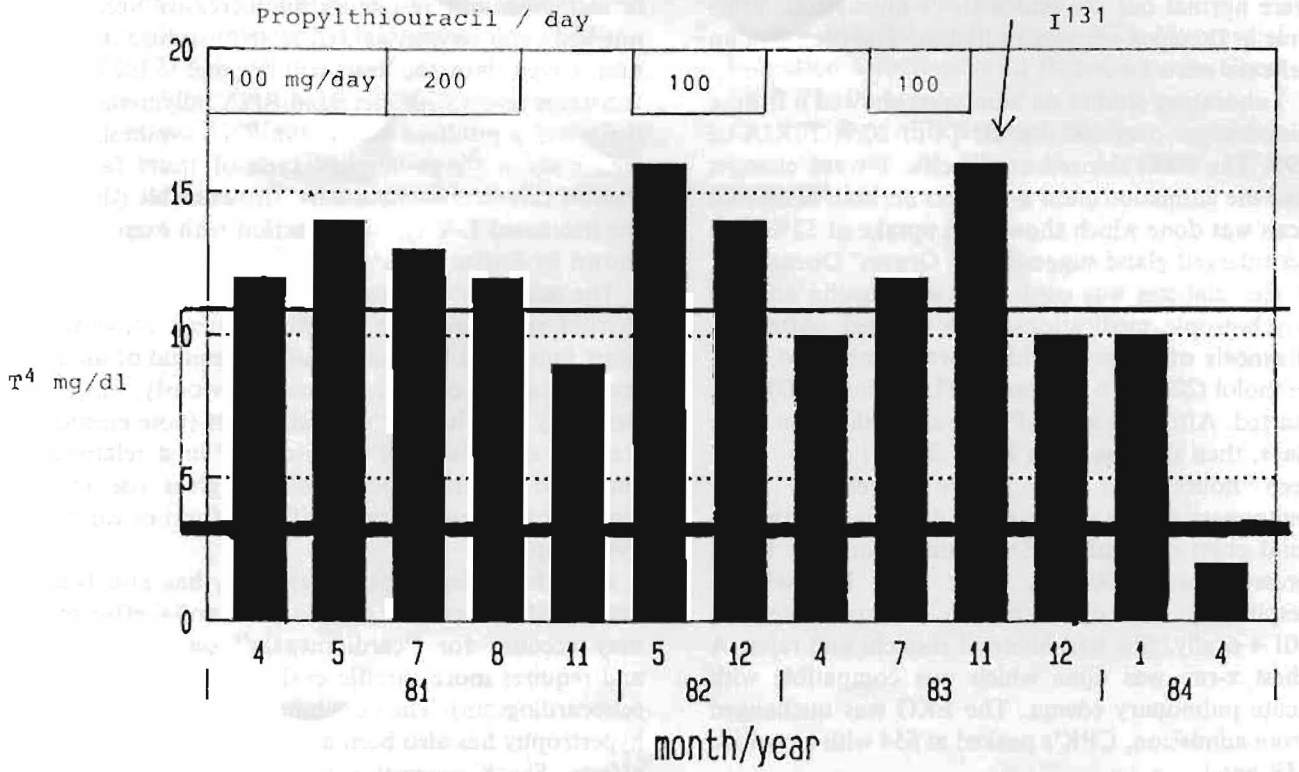

Figure 1: Case 1, Serial T4 and treatment course in hyperthyroidism.

her own.

The patient was next seen one month later with acute shortness-of-breath. Physical examination and chest x-ray confirmed the diagnosis of pulmonary edema. Other workup included an electrocardiogram which showed an old left anterior hemiblock and new lateral lead ST segment depression. Peak creatine phosphokinase (CPK) was 279 with an MB fraction of 48. Two dimensional echocardiogram showed a diffusely poor contractile left ventricle, especially noted in the apex and anterior wall. Radionucleide ejection fraction was 13%. Thyroid scan showed diffuse increase in uptake without focal abnormalities.

The patient's pulmonary edema rapidly cleared with appropriate therapy. After stabilization, the patient was treated with oral I^{131} (10.5mCi) and was discharged in stable condition. The T4 was repeated as an outpatient and was within normal limits (10.6).

Repeat hospitalization was required four months later when the patient again presented with pulmonary edema. On admission she had a blood pressure of 90/55 with a heart rate of 96 and a respiratory rate of 12/min. She was somnulent and only sluggishly responsive to questions. She had diffuse inspiratory rales and the cardiac exam showed an S_3 gallop.

Laboratory data included an admission arterial blood gas on 8 liter nasal cannula of $pO_2 = 40$, $pCO_2 = 75$, pH = 6.97 with a derived serum HCO_3 of 17. T4 drawn on admission was 1.2 with a thyroid stimulating hormone level of 77 (normal 0-6). CPK's reached 888 with an MB fraction of 177. The electrocardiogram was essentially unchanged from her previous admission.

The patient required endotrachial entubation and mechanical ventilation due to her deteriorating respiratory status. She was treated as before with diuresis, pre- and afterload reduction and inotropic support with resultant resolution of her congestive failure. After stabilization, radionucleide ejection fraction was repeated with a value of 17%.

The patient's hypothyroidism was initially treated with 0.05mg of levothyroxine/day. This dosage was gradually increased to 0.1 mg/day prior to discharge.

Case 2 JD, a 59-year-old white female was admitted from a nursing home for control of her diabetes. Her diabetes had been diagnosed 15 years before and was initially treated with diet. Insulin had been tried but she reportedly developed an allergic reaction to it. Medications at the time of admission included tolbutamide 1 gm TID, prochlorperazine 15mg BID, and haloperidol 10mg TID.

Symptoms on admission were palpitations, irritability, nervousness, dyspnea, and restlessness. On physical examination the patient appeared anxious. Her pupils were dilated and fixed in a "stare." Blood pressure was 190/90, heart rate 120. Lid-lag was present. The thyroid was diffusely enlarged, firm, nontender, and without nodules. On auscultation she

had apical rhonchi and wheezes. The heart sounds were normal but she had a II/VI holosystolic murmur at the apex without radiation. The deep tendon reflexes were 3+.

Laboratory studies on admission showed a fasting blood sugar over 300 mg/dl; T4 of 20.7; T3RIA of 395. The EKG showed nonspecific T wave changes and the admission chest x-ray was normal. A thyroid scan was done which showed an uptake of 52% with an enlarged gland suggestive of Graves' Disease.

Her diabetes was controlled with insulin and the psychotropic medications were stopped. After the diagnosis of hyperthyroidism was established, propranolol (20mg q 6 hrs.) and PTU (300mg BID) were started. After one week, PTU was withheld for three days, then she was given I^{131} (1.2 mCi) orally. Eighteen hours later the patient developed acute pulmonary edema with marked dyspnea, cough, and mild chest discomfort. On examination, her blood pressure was 200/100, heart rate 150 with a respiratory rate of 40/minute. Temperature was 101.4 orally. She had bilateral rhonchi and rales. A chest x-ray was done which was compatible with acute pulmonary edema. The EKG was unchanged from admission. CPK's peaked at 654 with a positive MB band.

She was then transferred to the intensive care unit, monitored, treated with propranolol and methyl prednisolone. Her pulmonary edema resolved within 12 hours with subsequent discontinuation of the steroids. The patient's remaining hospital course was essentially unremarkable and she was discharged in satisfactory condition on propranolol, 30mg. q 6 hours and PTU 400mg daily. Ejection fraction was performed prior to discharge which was 70%.

Discussion

Hyperthyroidism is frequently clinically manifested by palpitations (secondary to resting tachycardia or arrhythmia), tremulousness, exertional dyspnea, and anxiety. Hypothyroidism, conversely, is manifested by resting bradycardia, constipation, cold intolerance, and lethargy. These clinical symptoms do not completely explain, however, these two patients' congestive heart failure. It is possible that in both cases, the patients had underlying coronary artery disease and ischemic cardiomyopathies (most obviously in Case 1). Thyroid disease, then, may have exacerbated an underlying disorder.

It has been elegantly shown, as noted by Degroot[1], that the hyperthyroid state is associated with incresed stroke volume, cardiac output, pulse pressure, and decreased circulation time. Arrhythmias, both supraventrcular and ventricular are also common. Increased peripheral shunting with decreased left ventricular ejection time are also manifest.[2,3] Resting left ventricular ejection fraction is increased but often fails to increase with exercise[2,4]. Cardiac work is increased and results in an increased need for nutrients and oxygen as well as temperature regulation. Given time, the heart will respond to increased thyroxine levels with increased RNA polymerase activity and a resultant increase in RNA synthesis and frequently a "high-output" type of heart failure. Part of this "cardiomyopathy" is reversible (that of the decreased L-V ejection fraction with exercise) as shown by Forfar et al.[4]

The acute onset, however, of patient #1's hyperthyroid state probably directly induced congestive heart failure via the sudden added demand of an increased cardiac output. As noted previously, this patient may have had a "normal" heart (note ejection fraction of 70% prior to discharge in a relatively euthyroid state). Hyperthyroidism gives rise to a hyperdynamic but energy inefficient form of cardiac hypertrophy.

Hypothyroidism, not surprisingly, has also been associated with cardiac disease. Pericardial effusions may account for "cardiomegaly" on chest x-ray and requires more specific evaluation (e.g. M-mode echocardiogram). The possibility of asymetric septal hypertrophy has also been attributed to hypothyroid effects. Frank congestive heart failure, however, is not as frequently seen as with hyperthyroidism. Acute pulmonary edema is unusual.

The presence of an initial elevated CPK in patient #2 initially led to the admission of this patient to the Coronary Care Unit as a possible acute myocardial infarction. The lack of complaints of chest pain or a changed electrocardiogram, however, made this diagnosis less likely. The presence of elevated CPK in hypothyroid patients is unfortunately not always a reliable marker of myocardial infarction[6]. The hypothyroid state in patient #2 then, is seen as a contributing factor to a decrease cardiac function in an already borderline heart.

In summary, these two cases were presented to remind clinicians of the potential devasting cardiac effects of both hyper- and hypothyroidism. Diagnosed promptly, both are relatively amenable to treatment. It is therefore up to the clinician to see past the acute presentation of congestive heart failure and to look for these and other exacerbating factors.

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