Thyroid Storm and Lymphocytic Myocarditis

Yi-Ting Chen¹, Gee-Gwo Yang¹ and Yung-Hsiang Hsu²

Abstract

Cardiac failure is the leading cause of mortality in patients with thyroid storm. But the underlying cardiac pathology is unclear. Here, we report a 46-year-old woman who presented with hyperpyrexia and sinus tachycardia subsequent to accidental neck contusion. Her hyperthyroidism was verified by abnormal biochemical changes. Despite vigorous antithyroid treatment including a beta-blocker, glucocorticoid and potassium iodide, the patient eventually succumbed to refractory congestive heart failure in 4 days. Autopsy revealed lymphocytic myocarditis. We propose that lymphocytic myocarditis played a prominent role in her demise.

Key words: thyrotoxicosis, myocarditis, thyroid storm, heart failure

(Inter Med 49: 593-596, 2010)
(DOI: 10.2169/internalmedicine.49.2504)

Introduction

Thyroid storm is a life-threatening syndrome characterized by exaggerated clinical manifestation of thyrotoxicosis. Unrecognized and untreated, this disease entity has a very high mortality. The main clinical presentation includes fever, tachycardia, hypertension, mental confusion, gastrointestinal disorders and heart failure. The underlying cardiac pathology remains uncertain but lymphocytic myocarditis may play significant role in some patients.

Case Report

A 46-year-old woman fell down two flights of stairs, resulting in contusion and abrasions over her anterior neck, chest and forehead. Hours later, she became disoriented and combative. After 10 hours, the patient was rushed to our emergency department for evaluation. She had no known significant illness in the past. Upon examination, the patient was disoriented. Her heart rate was 132 beats/min, respiratory rate was 22/min, blood pressure was 161/83 mmHg and her body temperature was 40.6°C. Other than the aforementioned fresh traumatic neck abrasions, she had diffuse thyroidomegaly and a mild exophthalmos. Her neck was supple and there was no jugular venous distension. Cardiac examination showed a soft grade 2/6 systolic murmur at the apex, with faint S3 gallop. Her extremities were warm, sweaty, and her skin was unusually smooth. Her deep tendon reflexes were brisk and fine tremor was noted. The remaining examination was normal.

The admission and subsequent biochemical parameters are listed in Table 1. Antithyroid peroxidase antibody was markedly elevated at 3,792.5 ng/mL (normal, <60 ng/mL). Anti-TSH receptor antibody was 51.7% (normal, <15%). Antithyroglobulin antibody was 59.7 IU/mL (normal, 0–60 IU/mL). Our clinical suspicion of hyperthyroidism was unequivocally confirmed (Table 2). Her leukocyte count was 11,000/μL without left shift. Toxicology screening and blood cultures were all negative. Electrocardiography showed a regular sinus tachycardia. Computer tomography of head and neck were normal except for a diffusely enlarged thyroid gland (Fig. 1). The patient was immediately placed on intravenous dexamethasone (4 mg every 6 hours), oral propranolol (20 mg every 8 hours), oral propylthiouracil (300 mg every 6 hours) followed by potassium iodide solution as well as acetaminophen on top of usual supportive care. On the third day, the patient lapsed into a coma. She became hypotensive oliguric and also developed pulmonary edema and cold extremities. In view of hypotension, propranolol was withheld. Spinal fluid was normal. Repeated electrocardiography (ECG) began to show diffuse T-wave inversion.

¹Department of Internal Medicine, Tzu-Chi Buddhist Medical Center, Haulien, Taiwan and ²Department of Pathology, Tzu-Chi Buddhist Medical Center, Haulien, Taiwan

Received for publication May 23, 2009; Accepted for publication October 29, 2009
Correspondence to Dr. Yi-Ting Chen, kateytc@gmail.com
Table 1. Biochemical Studies at Admission and Day 4

<table>
<thead>
<tr>
<th>Variables</th>
<th>Creatinine, mg/dL</th>
<th>Bilirubin, mg/dL</th>
<th>AST, IU/L</th>
<th>ALT, IU/L</th>
<th>CK, IU/L</th>
<th>CK-MB, IU/L</th>
<th>CRP, mg/dL</th>
<th>Troponin I, ug/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference values</td>
<td>0.5–0.9</td>
<td>0.4–1.0</td>
<td>10–32</td>
<td>2–31</td>
<td>26–140</td>
<td>7–25</td>
<td>&lt;0.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission</td>
<td>0.3</td>
<td>3.0</td>
<td>70</td>
<td>28</td>
<td>810</td>
<td>-</td>
<td>4.19</td>
<td>0.74</td>
</tr>
<tr>
<td>Day 4</td>
<td>0.6</td>
<td>6.9</td>
<td>217</td>
<td>157</td>
<td>2010</td>
<td>135</td>
<td>3.54</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Abbreviations: AST = aspartate aminotransferase; ALT = alanine aminotransferase; CK = creatine phosphokinase; CK-MB = creatine kinase MB isoenzyme; CRP = C-reactive protein.

Table 2. Results of Thyroid Function Tests

<table>
<thead>
<tr>
<th>Variables</th>
<th>T₄, ug/dL</th>
<th>Free T₄, ng/dL</th>
<th>T₃, ng/dL</th>
<th>TSH, μIU/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference values</td>
<td>4.5–10.9</td>
<td>0.89–1.76</td>
<td>60–181</td>
<td>0.35–5.5</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission</td>
<td>&gt;30</td>
<td>&gt;12</td>
<td>&gt;800</td>
<td>&lt; 0.004</td>
</tr>
<tr>
<td>Day 3</td>
<td>19.8</td>
<td>7.31</td>
<td>250.5</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Abbreviations: T₄ = thyroxine; T₃ = triiodothyronine; TSH = thyroid-stimulating hormone

Figure 1. Computer tomography with contrast showed homogenous enlargement of the thyroid gland. The unit of scale is 1 cm.

(Fig. 2) and transthoracic echocardiography demonstrated global left ventricular hypokinesia. Despite vigorous resuscitative efforts, the patient died on the fourth day of hospitalization.

At autopsy, pertinent findings include diffusely enlarged thyroid gland without hematoma, bilateral lung congestion, 50 mL of serous pericardial fluid and a normal-sized heart. Microscopically, there was intense lymphocytic infiltration of the thyroid gland, diffuse hyperplasia, some follicular cell destruction, Hürthle cells and germinal center formation as shown in Fig. 3. Myocardial section showed lymphocytic myocarditis with moderate T lymphocyte (UCHL1 positive) infiltration (Fig. 4). Other findings were consistent with terminal hypoperfusion/hypoxic changes.

Discussion

The clinical presentations of marked tachycardia, confusion and hyperpyrexia, supported by an extremely elevated thyroid hormone parameter undoubtedly confirmed the diagnosis of thyroid storm. We believe that the patient had pre-existing hyperthyroidism prior to her neck injury. The presence of markedly elevated anti-TSH receptor antibody and antiperoxidase antibody, the pathological finding in her thyroid gland and clinical features support the diagnosis of Graves disease with Hashimoto autoimmune component. Contusion to her anterior neck evidently traumatized her presumed hyperplasic thyroid gland, which led to an acute and massive release of thyroid hormones, as “the last straw that breaks the camel’s back”, to cause thyroid storm.

Hyperthyroidism is known to increase cardiac output and typically causes the so-called “high-output” heart failure. However, cases of “low-output” heart failure have been observed. The proposed mechanisms include tachycardia-related cardiomyopathy, thyrotoxic cardiomyopathy, im-
Figure 2. Electrocardiogram showed sinus tachycardia on day 1. Diffuse T-wave inversion occurred on day 3.

Figure 3. Microscopically, the thyroid appeared to be early stage Hashimoto’s thyroiditis characterized by diffuse hyperplasia, lymphocyte infiltration with follicular cell destruction, and Hürthle cells and germinal center formation.

Figure 4. Panel A shows acute myocarditis with moderate lymphocyte infiltration and focal myocardial cell necrosis. Panel B shows UCHL1 staining of the myocardial section.

Based on the sequence of events, we postulate that our patient had a low-grade Graves disease and autoimmune lymphocytic myocarditis. As a result of her neck injury, the indirect blow to her thyroid resulted in a massive release of thyroid hormones which led to thyroid storm. This young patient without a history of known cardiac disease succumbed to intractable heart failure in a very short period of time due to thyroid storm. It is conceivable that she had pre-existing subtle lymphocytic myocardial damage. Consequently even a brief additional cardiac functional demand and insult led to profound myocardial dysfunction. We assume that heart failure in thyroid storm is due to protracted high cardiac demand. But in view of the finding of myocar-
dial lymphocytic infiltration in our patient, we cannot ignore the potential significant (autoimmune) myocarditis in some patients as in our case. It is advisable to assess cardiac status with echocardiography prior to the initiation of therapy. We could not totally exclude the possibility that the use of beta-blocker added insult to her heart failure. A beta-blocker agent if chosen should be used judiciously with caution. There has been evidence that cardiomyopathy is reversible after treatment for thyrotoxicosis (11, 12). In patients whose thyroid storm-related acute heart failure deteriorates despite optimal medical treatment, the mechanical augmentation of the failing left ventricular function could well be candidate “bridging measures” to the ultimate recovery of cardiovascular collapse.

In acute myocarditis, the ECG may show sinus tachycardia, nonspecific ST-T segment changes and T-wave abnormalities. Nakashima et al reported that ST-T changes in ECG could be found in all 11 consecutive patients with viral myocarditis (13). At the acute stage, ST elevation is very common, and three (27%) patients had ST depression or T-wave inversion instead of ST elevation. In the present case, the electrocardiographic findings shifted quickly from sinus tachycardia to global T-wave inversion in a short period of time. In patients of myocardial stunning due to sudden emotional stress, a similar evolutionary change has been observed. The initial ECG showed sinus rhythm in all 19 patients with stress cardiomyopathy; all but one had diffuse, deep, symmetric T-wave inversion within 48 hours after the onset of symptoms (14). But in the present patient, the echocardiographic findings favored the diagnosis of acute myocarditis, instead of Takotsubo cardiomyopathy.

In summary, we reported a case of thyroid storm triggered by a traumatic blow to her thyroid gland. At necropsy, the patient was found to have lymphocytic myocarditis as a component of Graves/Hashimoto autoimmunity. The possibility of preexisting myocardial dysfunction due to lymphocytic myocarditis should be considered before initiating the recommended treatment for thyroid storm. If a beta-blocker is chosen, close cardiac monitoring is warranted.

Acknowledgement
We would like to express our deepest gratitude to Professor Tah-Hsiung Hsu for his kindly instruction.

References


