Korean J Thorac Cardiovasc Surg 2014;47:294-297 □ Case Report □
ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2014.47.3.294

Successful Surgical Treatment of Cardiac Complication of Graves Disease

Jooncheol Min, M.D.[1], Woong-Han Kim, M.D., Ph.D.[1], Woo Sung Jang, M.D.[1], Eun Seok Choi, M.D.[1], Sungkyu Cho, M.D.[1], Kwang Ho Choi, M.D.[2]

Cardiac complications such as arrhythmia and heart failure are common in Graves disease. Early detection and proper treatment of hyperthyroidism are important because cardiac complications are reported to be reversible if the thyroid function is normalized by medical treatment. We report here a case of cardiac complication of Graves disease that was too late to reverse with medical treatment and required surgical treatment.

Key words: 1. Heart valve disease
2. Arrhythmia
3. Graves disease

CASE REPORT

A 15-year-old female patient was referred to Seoul National University Hospital with palpitation and chest pain. Three years previously, she had been diagnosed with Graves disease and her transthoracic echocardiogram (TTE) and electrocardiogram had revealed mild mitral regurgitation (MR), mild tricuspid regurgitation (TR), and atrial fibrillation (AF); however, the patient was lost at follow-up. She had not been compliant with medication and had had no medication for at least the 3 previous months. One week before she was referred, she had visited a hospital complaining of general weakness, palpitation, chest discomfort, cold sweat, and loss of 6 kg of body weight in 3 weeks; she was then diagnosed with thyroid storm. After 1 week of medical treatment for thyroid storm and improvement of symptoms, she was referred to Seoul National University Hospital for further management.

At the point of time that she was referred, the initial laboratory test showed high serum-free T_4 (2.12 ng/dL; normal range, 0.70 to 1.80 ng/dL), low serum thyroid stimulating hormone (TSH) (< 0.05 μIU/mL; normal range, 0.4 to 4.1 μIU/mL), and high titer of autoantibodies (thyroglobulin antibody, 110 IU/mL; normal range, 0 to 100 IU/mL; TSH receptor antibody, 13.8 IU/L; normal range, 0 to 1 IU/L) implying autoimmune hyperthyroidism such as Graves disease. Grade IV systolic murmur with irregular heart beat was auscultated, and the electrocardiogram revealed AF (Fig. 1A). Further, the chest radiograph showed severe cardiomegaly (Fig. 2A). The TTE revealed 58.5% of left ventricular ejection fraction (LVEF), moderate to severe MR with anterior leaflet prolapse, moderate TR with mild leaflet prolapse, and

Department of Thoracic and Cardiovascular Surgery, [1]Seoul National University Hospital, Seoul National University College of Medicine, [2]Pusan National University Yangsan Children's Hospital, Pusan National University College of Medicine
† Presented at the 257th monthly conference at Seoul and Gyeonggii province of the Korean Society for Thoracic and Cardiovascular Surgery.
Received: October 1, 2013, Revised: November 1, 2013, Accepted: November 5, 2013, Published online: June 5, 2014
Corresponding author: Woong-Han Kim, Department of Thoracic and Cardiovascular Surgery, Seoul National University Children's Hospital, Seoul National University College of Medicine, 101 Daehak-ro, Jongno-gu, Seoul 110-744, Korea
(Tel) 82-2-2072-3637 (Fax) 82-2-3672-3637 (E-mail) woonghan@snu.ac.kr

68.8 mm of left ventricular end diastolic diameter, which implied left ventricular dysfunction and enlargement (Fig. 3A).

After 11 days of medical treatment, the thyroid function test was normalized (free T_4, 1.24 ng/dL; TSH, 0.01 μIU/mL), but the heart failure and valvular dysfunction did not improve. We concluded that the heart including the valves and chordae had already been changed structurally and therefore, performed surgery. As intraoperative findings, the mitral valve showed diffuse chordae thinning and elongation with diffuse leaflet prolapse, and the tricuspid valve showed diffuse chordae thinning and elongation with severe anterior leaflet prolapse. Therefore, we performed mitral valvuloplasty making two artificial chordae at A2 and A3, respectively, mitral annuloplasty with a 32-mm Cosgrove ring, tricuspid valvuloplasty making 4 artificial chordae at the anterior leaflet, De Vega-type tricuspid annuloplasty, and Cox maze procedure. After the surgery, the TTE revealed improved cardiac function with 66.1% of LVEF, mild MR, and trivial TR, and decreased the left ventricular end diastolic diameter to 49.5 mm (Fig. 3B). The chest radiograph also showed an improvement of the cardiomegaly (Fig. 2B). The patient's cardiac rhythm was AF when she was discharged on postoperative day 16 but was converted to normal sinus rhythm from the first out-patient follow-up (postoperative day) to the last follow-up (2 years after operation) (Fig. 1B). Her thyroid function has also been controlled well (free T_4, 1.09 ng/dL; TSH, 1.26 μIU/mL at last follow-up) with medication including oral methimazole and levothyroxine.

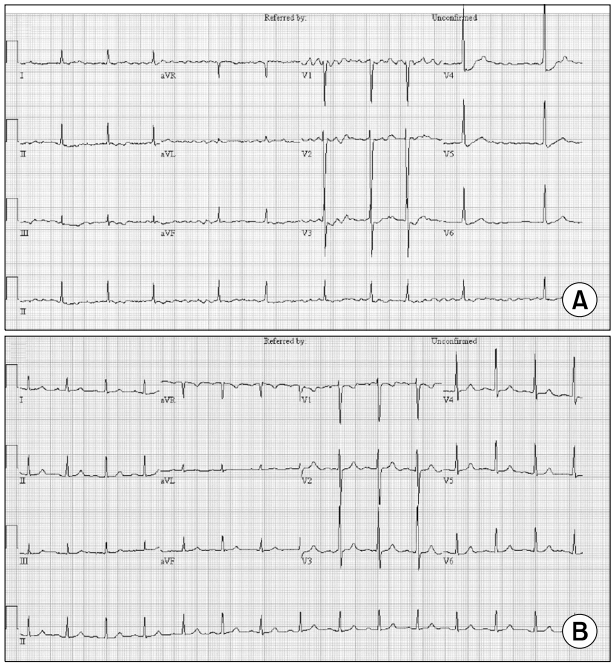

Fig. 1. (A) Preoperative electrocardiogram. (B) Electrocardiogram at 2 years after operation.

DISCUSSION

Thyroid hormone has effects on cardiovascular hemody-

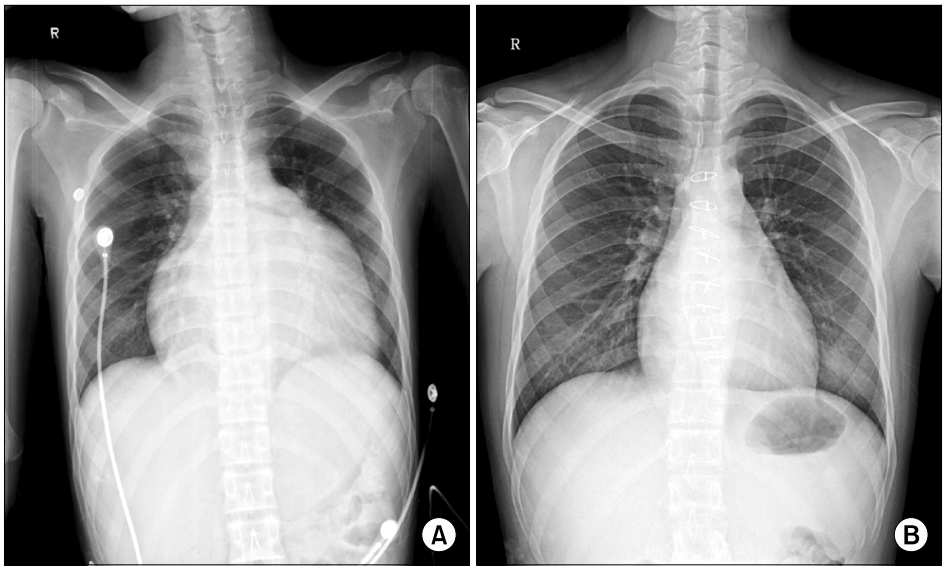

Fig. 2. (A) Preoperative chest radiography. (B) Chest radiography at 2 years after operation.

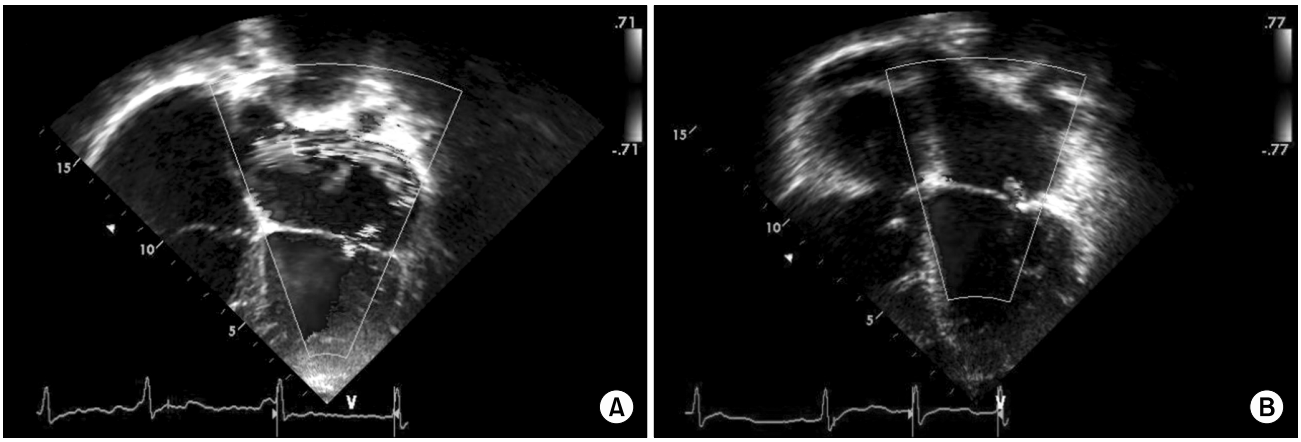

Fig. 3. (A) Preoperative transthoracic echocardiography showing moderate to severe mitral regurgitation. (B) Echocardiography on post-operative day 9 showing mild mitral regurgitation.

namics through its indirect effect on the peripheral vasculature and body metabolism, and through its direct effect on the heart. T_3 decreases the systemic vascular resistance (SVR) by promoting vasodilation with its genomic and nongenomic actions altering the vascular smooth muscle and the endothelial cell function. The decrease in SVR causes the mean arterial pressure to decrease, which, when sensed in the kidneys, activates the renin-angiotensin-aldosterone system and increases renal sodium absorption. T_3 also increases erythropoietin synthesis, which leads to an increase in the red cell mass. These changes combine to promote increases in the blood volume and the stroke volume. At the myocyte level, T_3 enhances contractility and relaxation of the myocardial cells through nontranscriptional effects on various ion channels and through transcriptional effects that regulate the release and uptake of sarcoplasmic reticular calcium and phosphorylation of phospholamban [1-3].

The most common cardiovascular symptoms and signs of hypothyroidism include bradycardia, mild hypertension (diastolic), narrowed pulse pressure, cold intolerance, and fatigue. Decreased thyroid hormone action causes increased SVR, decreased cardiac contractility, and decreased cardiac output. Further, it is well known that hypothyroidism is associated with accelerated atherosclerosis and coronary artery disease with elevated serum lipid levels. A variety of case reports have demonstrated that hypothyroidism may cause a prolongation of the QT interval that predisposes the patient to ventricular irritability, and torsade de pointes may result in rare cases. Most of the changes in the cardiac structure and function are potentially reversible with thyroid hormone replacement [1,4,5].

In hyperthyroidism patients, the cardiac output increases as a result of the combined effect of the increases in the resting heart rate, contractility, ejection fraction, and blood volume with a decrease in SVR. The condition that results from excess thyroid hormone may induce cardiac rhythm disturbance and heart failure. Almost every hyperthyroidism patient has sinus tachycardia, and the incidence of AF among the hyperthyroidism patients is approximately 13.8%, which is much higher than that of the normal population. Approximately 6% of the hyperthyroidism patients show heart failure as an initial clinical presentation, and half of them have left ventricular systolic dysfunction. Although the symptoms of heart failure and LVEF improve after the medical treatment of hyperthyroidism, persistent dilated cardiomyopathy develops in about one-third of these patients. Heart failure in the hyperthyroidism patients is mainly induced by sinus tachycardia or AF, as well as hypertension. In particular, a higher incidence of mitral valve prolapse has been reported in autoimmune hyperthyroidism such as Graves disease and Hashimoto's disease [1,2,6,7].

Xenopoulos et al. [8] reported a case of right heart failure associated with Graves disease, which required tricuspid valve repair for successful treatment of right heart failure. In our

case, medical correction of hyperthyroidism was too late to reverse the development of persistent dilated cardiomyopathy and the structural change of the heart including the valves; therefore, surgical treatment was necessary. To the best of our knowledge, this is the first case of a cardiac complication of Graves disease requiring surgical treatment reported in the Korean Journal of Thoracic and Cardiovascular Surgery. As an effort to prevent such severe complications, the cardiac function and rhythm should be monitored periodically in hyperthyroidism patients, and proper treatment of hyperthyroidism is essential [7]. Thyroid dysfunction should also be checked with a detailed history, physical examination, and thyroid function test in every patient with newly onset congestive heart failure.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Klein I, Danzi S. *Thyroid disease and the heart.* Circulation 2007;116:1725-35.
2. Riaz K, Forker AD, Isley WL, Hamburg MS, McCullough PA. *Hyperthyroidism: a "curable" cause of congestive heart failure: three case reports and a review of the literature.* Congest Heart Fail 2003;9:40-6.
3. Ojamaa K, Klemperer JD, Klein I. *Acute effects of thyroid hormone on vascular smooth muscle.* Thyroid 1996;6:505-12.
4. Fredlund BO, Olsson SB. *Long QT interval and ventricular tachycardia of "torsade de pointe" type in hypothyroidism.* Acta Med Scand 1983;213:231-5.
5. Palmieri EA, Fazio S, Lombardi G, Biondi B. *Subclinical hypothyroidism and cardiovascular risk: a reason to treat?* Treat Endocrinol 2004;3:233-44.
6. Siu CW, Yeung CY, Lau CP, Kung AW, Tse HF. *Incidence, clinical characteristics and outcome of congestive heart failure as the initial presentation in patients with primary hyperthyroidism.* Heart 2007;93:483-7.
7. Panagoulis C, Halapas A, Chariatis E, Driva P, Matsakas E. *Hyperthyroidism and the heart.* Hellenic J Cardiol 2008;49: 169-75.
8. Xenopoulos NP, Braden GA, Applegate RJ. *Severe right heart failure in a patient with Grave's disease.* Clin Cardiol 1996;19:903-5.