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Case Report

Atrial Fibrillation that is Extremely Resistant to External Electrical Cardioversion in a Patient with Thyroid Storm

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Abstract

Thyroid storm is a life-threatening state of thyroid hormone excess. Cardiac arrhythmias such as severe tachycardia and/or atrial fibrillation (AF) are some of the common symptoms of thyroid storm. Patients with thyroid storm tend to present with AF with rapid ventricular rate and hemodynamically instability. External electrical cardioversion is the general approach when treating such patients. Numerous factors have been proposed to influence the success rate of cardioversion such as duration of arrhythmia and extensive structural heart changes. Herein, we presented a case of 42-year-old female with no known past medical history of thyroid disorders presented with thyroid storm complicated with AF and hemodynamically instability. The AF was resistant to multiple trials of external electrical cardioversion, despite absence of any clinical or echocardiographic characteristics that are known to predict electrical cardioversion failure. The extreme resistant feature of the patient's AF was likely due to the underlying precipitating event - thyroid storm, despite being on thyroid treatment.

Keywords: *Atrial Fibrillation; Electrical Cardioversion; Thyroid Storm*

Introduction

Thyroid storm, a severe clinical manifestation of thyrotoxicosis is commonly triggered by an acute event causing an abrupt rise of serum thyroxine level, enhanced responsiveness to catecholamines or increased cellular responsiveness to circulating thyroid hormone [1]. Thyroid storm, a severe manifestation of thyrotoxicosis has an incidence of 0.20 per 100,000 hospitalized patients per year [2,3]. Cardiac arrhythmias such as severe tachycardia and/or atrial fibrillation (AF) are some of the common symptoms of thyroid storm [2]. Electrical cardioversion is generally the treatment of choice for patient with new onset of atrial fibrillation presented with hemodynamically instability. Herein, we report a case of 42-year-old African American female with no known past medical history of thyroid disorder presented with thyroid storm and complicated with new onset of rapid AF of less than 24 hours duration, which was resistant to external electrical cardioversion. Our case was unique, as the patient presented was not a known case of hyperthyroidism and the atrial fibrillation developed was resistant to external electrical cardioversion. Nonetheless, the pretreatment with amiodarone prior of external electrical cardioversion has successfully converted the atrial fibrillation into sinus rhythm.

Case Report

A 42-year-old female with past medical history of Type 2 diabetes mellitus diagnosed about a year ago, on metformin and glipizide presented to emergency department with the chief complain 20 lbs unintentional weight loss for the past one year, in which patient at-

tributed to medication side effects. In addition, patient also complained of fatigue, hot intolerance, and swelling on the neck area for a period of few months. Otherwise, patient denied tremors, diaphoresis, palpitations, hair loss, skin changes, nausea, vomiting, change in bowel movement, menstrual irregularities, fever, chills and rigors. Patient has no history of sick contact and recent flu-like symptoms. Patient has a family history of Type 2 diabetes mellitus and no family history of endocrine and cardiac disorders. She was a smoker, quit smoking about 10 years ago. She drinks alcohol occasionally, last used was 2 days prior of admission with 4 shots of vodka and 4 beers. She denied illicit drug use. Initial vital signs showed a temperature of 98.6-degree Fahrenheit, blood pressure 125/86 mmHg, heart rate 134/min, respiratory rate 18/min and was saturating 95% on room air. Physical examination notable for mild diffuse symmetrical, non-tender thyroid enlargement with no thyroid bruit, lid lag, exophthalmos, brittle nails, alopecia, and skin rashes. Otherwise, abdomen and lung examination were normal and cardiovascular examination revealed tachycardia, normal S1 and S2 with no murmurs, rubs and gallops. No S3 and S4 were appreciated. Patient was alert, awake and oriented to time, place and person, neurological examination was unremarkable. Initial workup revealed undetectable thyroid stimulating hormone, free T4 of & gt; 8.00, total T3 of 566, thyrotropin receptor serum antibody of 13.44, and Burch-Wartofsky Point Scale for thyrotoxicosis of 35. Electrocardiogram showed sinus tachycardia, normal axis and left atrial enlargement. Chest X-ray was unremarkable. Ultrasound of the thyroid showed thyromegaly, heterogeneous thyroid gland, compatible with chronic lymphocytic thyroiditis (Figure 1 and 2). There was also increased vascularity suggests superimposed active thyroiditis. Patient was then admitted to intensive care unit and started with propranolol 40 mg every 6 hours, propylthiouracil 150 mg every 4 hours and hydrocortisone sodium succinate 50 mg every 8 hours. Patient developed acute respiratory failure on the evening of admission with lethargic, confusion, respiratory rate 36/min and was suturing went down to 89% on 2L of oxygen, which subsequent leading to mechanical ventilation. Transthoracic echocardiogram performed on Day 2 revealed reduced ejection fraction of 25 to 30%, left ventricle was moderately dilated, global hypokinesis of the left ventricle, left atrium and right atrium were mildly dilated (Figure 3). On Day 5, patient developed new onset of atrial fibrillation with rapid ventricular rate (RVR) with heart rate of 170/min. Patient was given metoprolol tartrate push and started on labetalol drip, however, heart rate was persistently running high. Patient was given enoxaparin (1 mg/kg) and multiple attempts of external electrical cardioversion were then performed (100J, 120J, 150J and 3 times of 200J). Nonetheless, patient was resistant to external electrical cardioversion. Amiodarone 150 mg bolus was then given and synchronized cardioversion with 150J was performed and patient was finally converted back to normal sinus rhythm with the heart rate of 96/min. Patient was successfully extubated on Day 7 and downgraded to medical floor the next day.

Figure 1: *Ultrasound of the left thyroid long axis which showed heterogeneous enlargement of the left thyroid gland.*

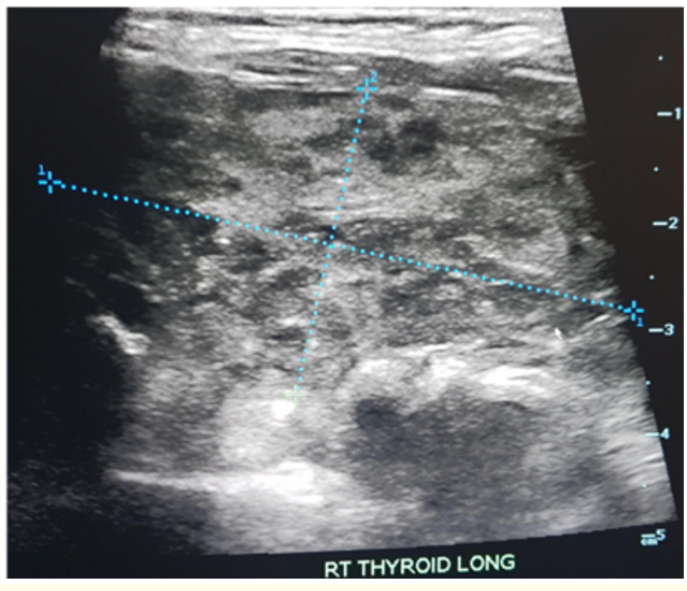

Figure 2: *Ultrasound of the right thyroid long axis which showed heterogeneous enlargement of the right thyroid gland.*

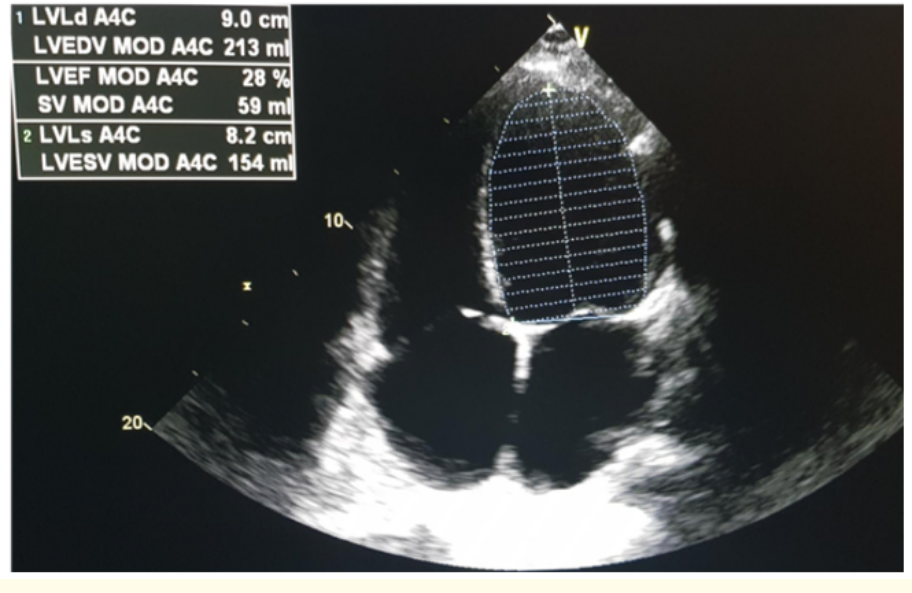

Figure 3: *Transthoracic echocardiogram revealed reduced ejection fraction of 25 to 30%, left ventricle was moderately dilated, global hypokinesis of the left ventricle, left atrium and right atrium were mildly dilated.*

Discussion

Thyroid gland is an endocrine gland located in the anterior neck regions. Numerous factors have been recognized affecting the synthesis and production of thyroid hormone, which includes acute illness, medications and comorbid illness. Thyroid storm is a severe clinical

manifestation of thyrotoxicosis with has high morbidity and mortality. There is no published data on the incidence and prevalence of thyroid storm in United States. According to the Japanese National Survey, the incidence of thyroid storm is about 0.20 per 100,000 hospitalized patients per year [2,3]. The exact pathophysiology leading to thyroid storm is poorly understood. Sarlis and Gourgiotis proposed that it may be triggered by an acute event causing an abrupt rise of serum thyroxine level, enhanced responsiveness to catecholamines or increased cellular responsiveness to circulating thyroid hormone [1]. It is also notable that thyroid storm is typically observed in patient with long standing thyrotoxicosis and precipitated by an acute change of events such as surgery, illness, infection, trauma, parturition and acute iodine load [3].

Cardiovascular symptoms such as congestive heart failure and arrhythmia are common presenting symptoms of thyroid storm. The pathophysiology behind of these cardiovascular manifestations were related to the cellular action of triiodothyronine (T3), which binds to nuclear receptor and transported to cardiac myocyte. T3 hormone on the heart will exhibit chronotropic and ionotropic stimulation, which increases both heart rate and cardiac contractility [4]. Akamizu reported that greater than 60 percent of patients with thyroid storm having severe tachycardia and/or AF [4]. The increase of heart rate with reduced heart rate variability secondary to decrease parasympathetic tone was proposed as the underlying mechanism contributing to the atrial ectopy which leading to paroxysmal atrial tachycardia, AF and atrial flutter in patients with hyperthyroidism and thyroid storm [5].

Majority of the rhythm of hyperthyroid patients with AF will convert spontaneously to sinus rhythm when the underlying hyperthyroidism is treated. Nonetheless, there are no study documented the rhythm conversion in patients with thyroid storm. Patient with thyroid storm tends to present with AF with rapid ventricular rate and hemodynamically instability. External electrical cardioversion is generally the approach in patients with new onset of AF with rapid ventricular rate and hemodynamically instability. We report a case of 42-year-old African American female with no known past medical history of thyroid disorder presented with thyroid storm and complicated with acute heart failure and AF.

Patients with hyperthyroidism have been shown to have enhanced systolic and diastolic function [6], which can lead to significant structural changes in the heart on the long term. Some of the structural changes may affect AF progression and treatment response. Echocardiography is a non-invasive method that can be used to study these changes. Left atrium is the most affected part by hyperthyroidism [7], many parameters were found to affect the outcome of the treatment. In most of the studies it was mentioned that the success rate of electrical cardioversion increases if the echocardiogram shows a preserved left atrial and left atrial appendage contractile functions [8], other studies on the other hands, show that the progression of the atrial fibrillation to a persistent and resistant one will depend on the left atrial strain as an independent factor [9].

Our case was unique, as the patient presented was not a known case of hyperthyroidism and the atrial fibrillation developed was resistant to external electrical cardioversion, albeit the patient does not have echocardiogram features that predicts the failure of cardioversion. Nonetheless, the pretreatment with amiodarone prior of external electrical cardioversion has successfully converted the atrial fibrillation into sinus rhythm.

Conclusion

Electrical cardioversion is generally the preferred treatment choice over pharmacologic cardioversion with higher success rate in patients with new onset of AF. This unique case of thyroid storm complicated with new onset of rapid AF of less than 24 hours duration, which was extremely resistant to external electrical cardioversion is extremely rare. This case hope to raise the awareness among physician and cardiologist on the potential resistant features of thyroid storm complicated by AF, which may require the pretreatment with pharmacologic agents such as amiodarone prior to external electrical cardioversion.

Bibliography

1. Sarlis N and Gourgiotis L. "Thyroid emergencies". *Reviews in Endocrine and Metabolic Disorders* 4 (2003): 129.

2. Akamizu T., *et al.* "Diagnostic criteria, clinical features, and incidence of thyroid storm based on nationwide surveys". *Thyroid* 22 (2012): 661.

3. Akamizu T. "Thyroid Storm: A Japanese Perspective". *Thyroid* 28 (2018): 32.

4. Klein I and Danzi S. "Thyroid disease and the heart". *Circulation* 116 (2007): 1725.

5. Wustmann K., *et al.* "Activation of electrical triggers of atrial fibrillation in hyperthyroidism". *The Journal of Clinical Endocrinology and Metabolism* 93 (2008): 2104.

6. Anakwue RC., *et al.* "Echocardiographic assessment of left ventricular function in thyrotoxicosis and implications for the therapeutics of thyrotoxic cardiac disease". *Therapeutics and Clinical Risk Management* 11 (2015): 189-200.

7. Panagoulis C., *et al.* "Hyperthyroidism and the Heart". *The Hellenic Journal of Cardiology* 49 (2008): 169-175.

8. Wang YC., *et al.* "Identification of good responders to rhythm control of paroxysmal and persistent atrial fibrillation by transthoracic and transesophageal echocardiography". *Cardiology* 104.4 (2005): 202-209.

9. Yoon YE., *et al.* "Echocardiographic Predictors of Progression to Persistent or Permanent Atrial Fibrillation in Patients with Paroxysmal Atrial Fibrillation (E6P Study)". *Journal of the American Society of Echocardiography* 28.6 (2015): 709-717.

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