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IATROGENIC CARDIAC ARREST DURING THYROID STORM

Taha Mansoor[1], Jaspreet Kaur[1], Maninder Randhawa[1], Anand Rai[1], Dylan Yu[1], Fatima Iqbal Khan[1], Santhosh Koshy[1,2]

[1] Department of Internal Medicine, Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, USA
[2] Department of Cardiology, Ascension Borgess Hospital, Kalamazoo, USA

Corresponding author's e-mail: taha.mansoor@wmed.edu

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ABSTRACT

Introduction: Thyroid storm is a life-threatening condition with often severe cardiac implications. Correct treatment choices can vary depending on underlying cardiac systolic function.

Case description: We present a case of a 47-year-old male with untreated Grave's disease who presented with a thyroid storm. After propranolol administration, he experienced a cardiac arrest with the return of spontaneous circulation after cardiopulmonary resuscitation. Further evaluation revealed severe thyroid-induced cardiomyopathy with left ventricular ejection fraction of 15–20%, which had decreased from 60–65% over one year. The patient was discharged home on hospital day 8 after an unremarkable ischaemic work-up. He experienced a full cardiac systolic function recovery with an ejection fraction of 60–65% at the 90-day follow-up.

Conclusion: Thyroid storm can present with overt or subclinical heart failure. Prompt evaluation of cardiac systolic function with a transthoracic echocardiogram before beta-blockade and the use of shorter-acting beta blockers can prevent devastating suppression of myocardial function.

KEYWORDS

Thyroid storm, cardiac arrest, beta blockers, cardiomyopathy

LEARNING POINTS

- Despite being first-line therapy, beta blockers can be beneficial or devastating in thyroid storm patients depending on the presence of low cardiac output or high cardiac output heart failure.
- Clinical awareness, prompt echocardiography and the use of shorter half-life beta blockers can prevent rapid cardiac deterioration in thyroid storm patients.

INTRODUCTION

Heart disease is a major cause of death in patients with hyperthyroidism, a hypermetabolic state due to excess thyroid hormone characterised by symptoms including weight loss, palpitations and heat intolerance[1]. A thyroid storm is an acute, life-threatening complication of a hyperthyroid state characterised by multisystem involvement. Long-term manifestations of a hyperthyroid

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state can include cardiomyopathy with impaired systolic function. Although beta blockers constitute a first-line treatment for hyperthyroidism, their impulsive use in cases of thyroid-induced cardiomyopathy can be devastating.

CASE DESCRIPTION

A 47-year-old male with Grave's disease and paroxysmal atrial fibrillation presented with three weeks of worsening dyspnoea, orthopnoea, diaphoresis and lower extremity swelling after discontinuation of methimazole treatment two months prior. He was tachycardic at 150 bpm, hypertensive at 150/95 mmHg, and found to have bilateral exophthalmos, lower extremity oedema and decreased lung sounds. Initial work-up also revealed thyroid stimulating hormone < 0.01 mIU/l and elevated free thyroxine of 2.1 ng/dl. A thyroid storm was diagnosed with propranolol, methimazole and hydrocortisone initiation. Shortly after, the patient suffered a pulseless electrical activity cardiac arrest with the return of spontaneous circulation achieved after 5 minutes of cardiopulmonary resuscitation. The patient required a brief intensive care unit stay for targeted temperature management and mechanical ventilation with intubation after his cardiac arrest. A transthoracic echocardiogram (TTE) showed severe right atrial and ventricular enlargement as well as an ejection fraction of 15–20%, reduced from 60–65% a year prior. The patient was diuresed with the initiation of goal-directed medical therapy for heart failure with reduced ejection fraction (HFrEF) and careful addition of metoprolol on day 4 of hospitalisation. Ischaemic work-up revealed normal coronary arteries after which the patient was discharged following symptom resolution on day 8 of hospitalisation. The patient remained compliant with his medication regimen with close endocrinology, cardiology and primary care follow-up, and fully recovered his left ventricular systolic function with an ejection fraction of 60–65% at a 90-day outpatient follow-up.

DISCUSSION

We describe a case of thyroid storm in a 47-year-old male with untreated Grave's disease and secondary cardiomyopathy with HFrEF, who developed cardiac arrest after further myocardial suppression with propranolol administration.

Hyperthyroidism has profound cardiovascular system effects. The thyroid hormone decreases systemic vascular resistance and increases blood volume, heart rate and cardiac contractility, which can culminate in high-output heart failure[2]. Eventually, long-term inadequately treated thyrotoxicosis can cause systolic failure with thyrotoxic dilated cardiomyopathy from the direct effects of long-standing thyroid hormone stimulation[3]. This is perpetuated by tachycardia-induced cardiomyopathy from persistent chronotropic stimulation or atrial fibrillation from hyperthyroidism. Finally, these changes result in decreased left ventricular ejection fraction and heart failure with HFrEF.

The mainstays of thyroid storm treatment are beta blockers, thionamides such as methimazole, and glucocorticoids. Beta blockers, especially propranolol, reduce beta-receptor-mediated adrenergic stimulation. This is because elevated thyroid hormone levels result in increased beta-adrenergic receptor expression, including in the heart, which can be inhibited with beta blockers[4]. However, in the case of low-output heart failure with systolic dysfunction, beta blockers can disrupt the compensatory hyperadrenergic mechanisms of the cardiomyopathic state and decrease cardiac output. As such, beta blockers should be used with caution in patients with thyroid storm presenting with decompensated heart failure, as they can precipitate deadly cardiogenic shock.

The management of thyroid storm presents an important decision for the clinician. Although beta blockers will be beneficial for those with high-output heart failure, patients with low-output heart failure can decline rapidly. Furthermore, patients with thyroid storm can often present with subclinical heart failure. As such, a TTE should be performed as soon as possible to evaluate and monitor left ventricle function in all patients with thyroid storm with subsequent medication selection based on ejection fraction[5]. Furthermore, a safer alternative to propranolol for thyroid storm patients is esmolol, a very short-acting beta blocker that can be more carefully titrated and promptly discontinued at the first sign of cardiac function worsening[5].

CONCLUSION

A thyroid storm can present with clinical or subclinical heart failure. Rather than an impulsive non-selective, longer-acting beta blocker administration such as propranolol, urgent cardiac systolic function evaluation with a TTE is required. Short-acting beta blockers such as esmolol are a safer alternative in these patients as their negative inotropic effects can be rapidly reversed with discontinuation.

REFERENCES

1. Ertek S, Cicero AF. Hyperthyroidism and cardiovascular complications: a narrative review on the basis of pathophysiology. *Arch Med Sci* 2013;**9**:944.
2. Klein I, Danzi S. Thyroid disease and the heart. *Circulation* 2007;**116**:1725–1735.
3. Molinaro G, Vecchis R De, Badolati E, Giannattasio R. Thyrotoxic dilated cardiomyopathy: personal experience and case collection from the literature. *Endocrinol Diabetes Metab Case Rep* 2020;**2020**:20–0068.
4. Bilezikian JP, Loeb JN. The influence of hyperthyroidism and hypothyroidism on alpha- and beta-adrenergic receptor systems and adrenergic responsiveness. *Endocr Rev* 1983;**4**:378–388.
5. Wang S, Zhao Y, Yang Y, Pan Y, Wang K. Echocardiography used for treatment in heart failure accompanied by thyroid storm: case report and literature review. *Clin Case Rep* 2024;**12**:e9234.