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Case Report

Evaluating the Role of Thyroid Hormone Replacement in Pediatric Patients with Hashimoto's Thyroiditis-Induced Dilated Cardiomyopathy

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Abstract

Background*: Hashimoto's thyroiditis is the leading cause of hypothyroidism in iodine-sufficient pediatric populations and is associated with various multisystemic effects, including cardiovascular complications such as dilated cardiomyopathy (DCM).*

Objective*: This case report aims to delineate the pronounced potential for cardiac recovery in pediatric patients afflicted with DCM secondary to hypothyroidism when managed with thyroid hormone replacement therapy (THRT).*

Case Description: *A 12-year-old male presented with fatigue, growth delay, and cardiac symptoms. Clinical evaluation revealed Hashimoto's thyroiditis and secondary DCM, characterized by reduced ejection fraction and notable left ventricular dilation. The patient was treated with tailored hormone replacement therapy (THRT) besides to standard heart failure management protocols.*

Results: *Post-THRT, the patient demonstrated marked improvement in both thyroid and cardiac function. Thyroid-stimulating hormone levels normalized, and cardiac imaging showed substantial recovery in ventricular function, with the ejection fraction increasing from 41% to 67% over three months.*

Conclusion: *This case highlights the reversible nature of cardiomyopathy with THRT in pediatric patients with Hashimoto's thyroiditis. It underscores the importance of early thyroid function screening in patients presenting with unexplained cardiomyopathy and suggests that THRT can significantly enhance cardiac outcomes. Further research is advocated to validate these findings and explore the underlying mechanisms of thyroid hormone action on the pediatric heart.*

Keywords: *Hashimoto's thyroiditis, pediatric dilated cardiomyopathy, thyroid hormone replacement therapy, pediatric cardiology, endocrine disorders, ejection fraction, thyroid function.*

Introduction

Hashimoto's thyroiditis is the most common autoimmune thyroid disorder and the leading cause of hypothyroidism in children where iodine deficiency is not a concern. (1,2) This condition is increasingly recognized for its potential to affect multiple organ systems beyond the thyroid, notably the cardiovascular system. Pediatric patients with Hashimoto's thyroiditis are particularly vulnerable to developing secondary complications such as dilated cardiomyopathy (DCM), a serious cardiac dysfunction that can significantly impair quality of life and increase morbidity. (3)

Thyroid hormones, including thyroxine (T4) and triiodothyronine (T3), play pivotal roles in regulating metabolism and energy homeostasis within the cardiovascular system. (4,5) In the pediatric context, the implications of thyroid dysfunction are profound, with hypothyroidism linked to detrimental changes in cardiac morphology and function. These changes can manifest as dilated cardiomyopathy, characterized by ventricular dilation and reduced myocardial performance, often necessitating comprehensive clinical management. (6)

Despite the clear association between thyroid function and cardiac health, the literature remains sparse on the specific impact of thyroid hormone replacement therapy (THRT) on reversing cardiac abnormalities in children with Hashimoto's-induced DCM. Current research predominantly focuses on adults, leaving a significant knowledge gap in pediatric care. (7)

This case report aims to highlight the significant potential for cardiac recovery in pediatric DCM when it is secondary to hypothyroidism and managed with thyroid hormone replacement. By documenting and discussing this recovery, we contribute to a better understanding of the critical impact of thyroid hormones on the pediatric heart and the importance of considering endocrine etiologies in cases of pediatric cardiomyopathy. (8) The implications for clinical practice are profound, suggesting that early intervention in the thyroid axis can dramatically alter the prognosis for pediatric patients with DCM.

Case Presentation

A 12-year-old male presented to our hospital with complaints of fatigue on exertion persisting for 2 years, alongside noticeable swelling in the face and eyelids, and pale, dry skin which had been worsening over the past year. His medical history was unremarkable, with no previous diagnosis of any chronic diseases.

Clinical Findings

On examination, the patient appeared undernourished with noticeable growth delays, standing at a height of 121 cm and weighing 27 kg, which placed him significantly below the standard growth parameters for his age. Notable findings included puffiness of the face and generalized dryness of the skin. Vital signs were recorded, showing a heart rate of 90 beats per minute, a blood pressure of 95/55 mmHg, and a respiratory rate of 24 breaths per minute. The thyroid gland was palpated and found to be of normal size without any nodularity. Cardiac examination revealed normal heart sounds, no murmurs, and no pericardial rubs, with normal peripheral pulses. Respiratory examination was normal, with equal bilateral air entry and no crepitations.

Diagnostic Focus and Assessment

Given the clinical presentation, a series of investigations was initiated. A chest X-ray indicated a mild enlargement of cardiac size but no other abnormalities. An echocardiography was performed revealing a dilated left ventricle with dysfunction characterized by an ejection fraction (EF) of 41% and fractional shortening (FS) of 22%. The dimensions included a left ventricular end-diastolic diameter (LVdid) of 48 mm and an end-systolic diameter (LVdis) of 37 mm, along with trivial pericardial effusion. An electrocardiogram (ECG) was conducted and returned normal results.

Further, a thyroid ultrasound showed mild hypertrophy in the right lobe without the presence of nodules or cysts, and laboratory tests were conducted revealing a significant thyroid dysfunction with a thyroid-stimulating hormone (TSH) level of 100 mIU/L, low free T4 (FT4) of 0.25 ng/dL, and markedly elevated anti-thyroid peroxidase (anti-TPO) antibodies at 2000 IU/mL. Additional tests indicated normal complete blood count, kidney function, negative Anti-Tissue Transglutaminase IgA (anti-TTG IgA), glycated Hemoglobin (HbA1c): 6.2%, slightly elevated AST and ALT, and a creatine kinase (CK) level of 868 U/L.

Diagnosis

Based on the clinical presentation and diagnostic findings, a diagnosis of Hashimoto's disease with secondary dilated cardiomyopathy was established.

Therapeutic Intervention and Follow-up

Initial management included the administration of heart failure medications, specifically diuretics and captopril, and the commencement of levothyroxine at a dose of 50 mcg per day to address the hypothyroidism. Follow-up over the next month showed an improvement in thyroid function with a decrease in TSH to 25

mIU/L and an increase in FT4 to 0.6 ng/dL. However, echocardiography still displayed persistent cardiomyopathy with a slight improvement in EF to 45%.

Consequently, the levothyroxine dosage was increased to 100 mcg per day. Subsequent assessments showed continued improvements in thyroid function and cardiac structure. After three months, echocardiography indicated normalization of the left ventricular size and function with an EF of 67% and FS of 37%. At this point, cardiac medications were discontinued, and the patient continued on levothyroxine therapy alone.

Discussion

The association between Hashimoto's thyroiditis and dilated cardiomyopathy in pediatric patients highlights the complex interactions between endocrine disorders and cardiac diseases. This relationship serves as a prime example of the extensive systemic effects of Hashimoto's thyroiditis, especially its influence on heart function. Understanding these connections is crucial for practitioners in pediatric endocrinology and cardiology, as it informs a more integrated approach to patient care.

Pathophysiology and Diagnostic Challenges

Hashimoto's thyroiditis is well-recognized for inducing hypothyroidism, which can lead to various systemic effects, including cardiovascular complications. The role of thyroid hormones in cardiovascular health is crucial; they regulate myocardial contractility, heart rate, and vascular resistance. The deficiency of these hormones, as seen in hypothyroidism, can adversely affect cardiac output and lead to structural heart changes, such as those observed in dilated cardiomyopathy. (9)Pediatric patients present unique challenges in diagnosis, as the symptoms of cardiac dysfunction can be subtle and often attributed to more benign causes, such as physical deconditioning or respiratory disorders. (10)

Therapeutic Interventions and Outcomes

The reversibility of cardiomyopathy with thyroid hormone replacement therapy (THRT) as documented in this case is a critical observation that aligns with existing literature. Prior studies have indicated that optimal thyroid management can lead to significant improvements in cardiac function, suggesting a direct link between improved thyroid hormone levels and cardiac recovery. (11) This case contributes valuable empirical evidence supporting this link, demonstrating marked improvement in cardiac function as thyroid status was normalized. Moreover, the initial management of heart failure symptoms with diuretics and captopril was crucial for stabilizing the patient's condition, allowing time for the THRT to take effect. This integrated approach of

managing both the symptomatology and the underlying cause is highlighted in the literature as an effective strategy for similar cardiac conditions influenced by metabolic disturbances. (12)

Clinical Implications and Future Directions

This case underscores the importance of considering thyroid dysfunction in pediatric patients presenting with unexplained cardiomyopathy. It also suggests the need for routine screening of thyroid function in such clinical scenarios to facilitate early diagnosis and treatment, which could significantly alter the prognosis. Furthermore, this case demonstrates the potential for complete reversibility of cardiomyopathy with appropriate thyroid hormone management, a finding that could have profound implications for the management strategies of pediatric cardiomyopathy associated with endocrine disorders.

Future research should focus on longitudinal studies to more definitively ascertain the long-term outcomes of pediatric patients treated for Hashimoto's thyroiditis with associated cardiomyopathy. Additionally, more extensive studies could explore the molecular mechanisms by which thyroid hormones influence cardiac function, which could open new therapeutic avenues for managing cardiomyopathy not only in the context of thyroid dysfunction but in other metabolic imbalances as well.

Conclusion

The significant improvement in cardiac function with targeted thyroid hormone replacement in this pediatric case of Hashimoto's thyroiditis-induced dilated cardiomyopathy reinforces the critical role of comprehensive hormonal assessment in patients with unexplained cardiac symptoms. This case enriches the pediatric endocrinology and cardiology literature by detailing a successful intervention strategy and highlights the importance of interdisciplinary approaches in managing complex pediatric conditions.

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