

Thyroid Storm in an Adolescent Girl Precipitated by Empyema Thoracis

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Abstract

Thyroid storm is a rare, life-threatening condition in children. We report a 16-year-old adolescent girl who presented to us with fever, cough, chest pain, and breathing difficulty. On the initial evaluation, a working diagnosis of left-sided pneumonia with empyema was made. She was also noted to have persistent tachycardia, which was out of proportion to the fever and a staring look. She was evaluated further and found to have a thyroid storm. Timely diagnosis and appropriate management of thyroid storm proved to be lifesaving.

Keywords: Empyema, Hyperthyroidism, Thyroid storm

Introduction

Hyperthyroidism is a rare but potentially serious condition in childhood. Its reported incidence in postpubertal children is 0.9 per 100,000.¹ Graves' disease is the most common cause of hyperthyroidism in children, accounting for more than 95% of the cases. Clinical manifestations of hyperthyroidism are highly variable. Thyroid storm is an extreme manifestation of hyperthyroidism and a medical emergency.² Thyroid storm can manifest anytime in underlying hyperthyroidism. Though manifestations of thyrotoxicosis are typical, a high index of suspicion should be kept in any patient who presents with systemic decompensation. Thyroid storm as an initial manifestation is not common, especially in children where its diagnosis becomes very challenging.³

We report here a case of an adolescent girl who presented with left-sided pneumonia with empyema and had tachyarrhythmia, which on further evaluation turned out to be thyroid storm.

Case Report

A 16-year-old female, presented in the emergency department with complaints of fever, cough, and chest pain for 15 days and progressive breathing difficulty for 12 days. On examination, she was conscious, had fever, tachypnea (RR; 38/min) with chest retraction, tachycardia (HR=128/min), and raised blood pressure (BP=147/87mm of Hg). On the respiratory system examination chest movement was decreased dull percussion notes, and reduced air entry on left interscapular, infrascapular, and infra-axillary area. A chest x-ray showed massive left-sided pleural effusion with mediastinal shift to the right (Fig 1A). In USG Chest, there was moderate to severe effusion with loculation and thick septation on the left side. A diagnosis of left-sided pneumonia with empyema was made. She was started on intravenous antibiotics (Amoxicillin

and clavulanic acid) and an intercostal drainage (ICD) tube was inserted. Intra-pleural Urokinase in a dose of 40000 IU in 40 mL of normal saline was also instilled as per the British Thoracic Society (BTS) guideline.⁴



Figure 1: Chest X-ray PA view. **A:** complete white out of left hemithorax with mediastinal shift to the right, **B:** Dense opacity in left hemithorax with some aeration, **C:** 6-weeks post-surgery showing marked improvement with an air pocket in the left lower lobe.

During the emergency stay, she was found to have persistent tachycardia, which was out of proportion to fever (HR-148/min, temp-100.1⁰ F) with irregular rhythm and wide pulse pressure. An electrocardiograph (ECG) showed atrial fibrillation. She was also noted found to have exophthalmos, tremors of outstretched hand and a thyroid swelling in the neck. She was also evaluated for other causes of tachyarrhythmia as per Pediatric Advanced Life Support (PALS) guidelines which include 6H (Hypovolemia, hypoxia, acidosis, hypoglycemia, hypo/hyperkalemia and hypothermia) and 5T (pneumothorax, tamponade, trauma, thromboembolism and exposure to toxins),⁵ but there was no evidence of any of these conditions. A possibility of hyperthyroidism was considered and investigated. . The thyroid profile revealed a very high level of free T3& T4 with a very low TSH (FT3: 27.8 pg/ml FT4: 7.16 ng/dl and

TSH<0.004 mIU/L). The Burch and Wartofsky's score was 65, a score more than 45 is considered highly suggestive of thyroid storm.⁶ A working diagnosis of hyperthyroidism with thyroid storm was kept and she was started on Propranolol (20 mg every 6 hourly) and Methimazole (0.5mg/kg/day in two divided doses).. She showed significant clinical improvement in tachyarrhythmia in the next 48 hours.

Meanwhile, she continued to have a fever and breathing difficulty, therefore the antibiotic was upgraded (Piperacillin + Vancomycin). On repeat, chest imaging, there was dense opacity in the left hemithorax with some aeration (fig 1B) and in the USG chest, there was plenty of pus with thick septa despite the six doses of intrapleural Urokinase. Pediatric surgery consultation was taken and she underwent video-assisted thoracoscopic surgery (VATS). Following the procedure there was a significant clinical and radiological improvement (fig 1C). A repeat thyroid profile at two weeks was also showed improvement in thyroid function (FT3: 8.46pg/ml FT4: 4.17 ng/dl and TSH<0.004 mIU/L). In due course, her ICD tube was removed and the child was discharged on anti-thyroid medications and oral antibiotics with a plan to complete a total six weeks course of antibiotics. On follow up at six weeks, she gained adequate weight, and there was no recurrence of symptoms. Child did not show any adverse effects with Propranolol and Methimazole.

Discussion

Graves' disease is the most common cause (>95%) of hyperthyroidism in children.² Thyroid storm is considered as an extreme manifestation of hyperthyroidism. It is a life-threatening condition, with a mortality of 8-25 %.³ Evidence has shown that any acute illness, such as stroke, surgery, infection, or trauma, can precipitate the thyroid storm.⁷ There is a case report by Yuan et al. in which a thyroid storm was precipitated by organophosphorus poisoning.⁸ A case

report by Ivy R A et al. demonstrates that the Respiratory Syncytial Virus (RSV) Infection had precipitated thyroid storm in an underlying undiagnosed Grave's disease.⁹ Underland LJ et al. had reported a case of 5 years old child with streptococcal pharyngitis who subsequently developed cardiomyopathy and post-streptococcal glomerulonephritis (PSGN) with thyroid storm. In their case Burch-Wartofsky score was 70 and they have also used β 2 blocker and methimazole for acute management.¹⁰ Recently, Ladd J M et al. had reported a case of thyroid storm in 2 years and nine months old child presenting with a febrile seizure; they also observed persistent tachycardia and wide pulse pressure in their index case.³

Pneumonia with empyema thoracis was seemed to be a precipitating factor in the index case. The role of infections in triggering thyroid storm is not well elucidated; however, the postulated mechanism is that infection may decrease the serum binding of T3 and T4, which leads to increase free T3 (fT3) and T4 (fT4) level, ultimately result in thyroid storm.⁷ Rarely, thyroid storm could be an initial presentation of underlying hyperthyroidism.^{2,7}

The diagnosis of thyroid storm is mainly clinical. There are many clinical scoring tools are in practice to predict the underlying thyroid storm, the Burch-Wartofsky criteria is most widely used. A score more than ≥ 45 is highly suggestive of thyroid storm while 25-44 is considered as suggestive and score < 25 is unlikely to have thyroid storm.⁶ Guidelines from the American Thyroid Association and AACE (American Association of Clinical Endocrinologists) suggest a multimodality treatment approach with close monitoring in an intensive care unit.¹¹

The treatment options include antithyroid medications (Methimazole and propylthiouracil), β -adrenergic blocker (propranolol, atenolol, metoprolol, nadolol or esmolol), inorganic iodine solutions, radioiodine therapy (¹³¹I therapy), other drugs (corticosteroid, lithium carbonate, cholestyramine, rituximab) and surgical treatment.¹² In the index case, Methimazole was started

as it is considered as the first line of therapy in children along with propranolol, which shows significant clinical and biochemical improvement in the course of two weeks.

To conclude thyroid storm can be the initial presentation of underlying hyperthyroidism in children, and it could be precipitated by infection as pneumonia with empyema in the index cases. Since it is a life-threatening condition, a high degree of suspicion and early institution of therapy is vital.

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