

Atrial fibrillation in an asthmatic patient with albuterol-induced lactic acidosis

Fibrilație atrială la un pacient astmatic cu acidoză lactică indusă de albuterol

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Abstract

Asthma is a highly prevalent chronic respiratory disease affecting millions of people worldwide. Short-acting beta 2-agonists induce bronchodilation and usually are prescribed as a rescue medication. They are recognized as a cause of hyperlactatemia and, less frequently, lactic acidosis. Short-acting beta 2-agonists are also known for their potentially adverse cardiovascular effects, such as atrial fibrillation. Differential diagnosis and subsequent treatment of the latter entity are important due to the adverse prognosis related to it. In this case report, we describe the unusual association between albuterol-induced lactic acidosis and atrial fibrillation in a patient with an asthma exacerbation.

Keywords: Acidosis, Lactic; Albuterol; Asthma; Atrial Fibrillation

Rezumat

Astmul este o boală respiratorie cronică extrem de răspândită care afectează milioane de oameni din întreaga lume. Beta 2 agonistii cu durată scurtă de acțiune induc bronhodilatație și, de obicei, sunt prescrise ca un medicament de salvare. Aceste medicamente sunt recunoscute ca fiind o cauză de hiperlactatemie și, mai puțin frecvent, de acidoză lactică. Beta 2 agonistii cu durată scurtă de acțiune sunt de asemenea cunoscuți pentru potențialele lor efecte adverse cardiovasculare, cum ar fi fibrilația atrială. Diagnosticul diferențial și tratamentul ulterior al acestei entități sunt importante datorită prognosticului legat de aceasta. În această raportare de caz, vom descrie asocierea neobișnuită dintre acidoza lactică indusă de albuterol și fibrilația atrială la un pacient cu exacerbare de astm.

Cuvinte-cheie: acidoză lactică, albuterol, astm, fibrilație atrială

Introduction

The lifetime risk for atrial fibrillation (AF) is approximately 25% in the general population⁽¹⁾. However, the risk of new-onset AF is 1.2-fold higher in asthma patients, suggesting that asthma may play an important role in arrhythmogenesis⁽²⁾. On the other hand, hyperlactatemia (and less commonly lactic acidosis) has been detected in patients with asthma exacerbations treated with short-acting beta 2-agonists⁽³⁾. Traditionally, hyperlactatemia in patients with acute asthma has not been considered as a marker of adverse outcomes⁽³⁾. Nevertheless, there are a few cases of complications resulting from lactic acidosis⁽⁴⁾.

In this case report, we describe a male patient with severe asthma exacerbation who developed albuterol-induced lactic acidosis and subsequently AF during his stay in the emergency department (ED).

Case report

A 59-year-old male with a long history of persistent partly controlled asthma presented to ED with a 3-day history of dry cough, tachypnea, shortness of breath, audible wheezing, and mild chest pain. His chronic medication consists of three or four puffs of ipratropium bromide/albuterol sulfate per day. He denied any use of tobacco or recreational drugs, as well as cardiovascular risk factors, a family history of atopic disease, a history of coronary heart disease, or any other health conditions. He had never had a spirometry test before.

In his chest radiograph he had no cardiomegaly or infiltrates. Inhaled bronchodilators and intravenous hydrocortisone (100 mg twice daily) were started. The patient received five doses of nebulized albuterol through a mouthpiece (total dose of 32.5 mg) as well as 0.5 mg of ipratropium bromide. He showed no improvement after this initial treatment.

On arrival, he had sinus tachycardia. While staying in the ED, he developed lactic acidosis (Figure 1) and subsequently rapid AF (up to 145 bpm) without haemodynamic instability. In order to slow this heart rate, 10 mg of verapamil were given as a single intravenous dose. His heart rate was thus decreased to about 120 bpm, and he remained haemodynamically stable during this period. A transthoracic echocardiogram was performed and no abnormalities were found. His thyroid profile was within the normal range. His stroke risk according to the CHA2DS2-VASc score was very low and, following the current recommendations⁽⁵⁾, we decided not to start therapeutic anticoagulation.

After albuterol discontinuation, his asthma exacerbation was treated with nebulized ipratropium bromide (0.5 mg every 4 hours) and intravenous magnesium sulfate (2 g over 20 minutes). The patient showed a significant improvement in his respiratory status. Lactate and pH levels gradually normalized with subsequent conversion to sinus rhythm. He was discharged home days later with no symptoms and on prednisone

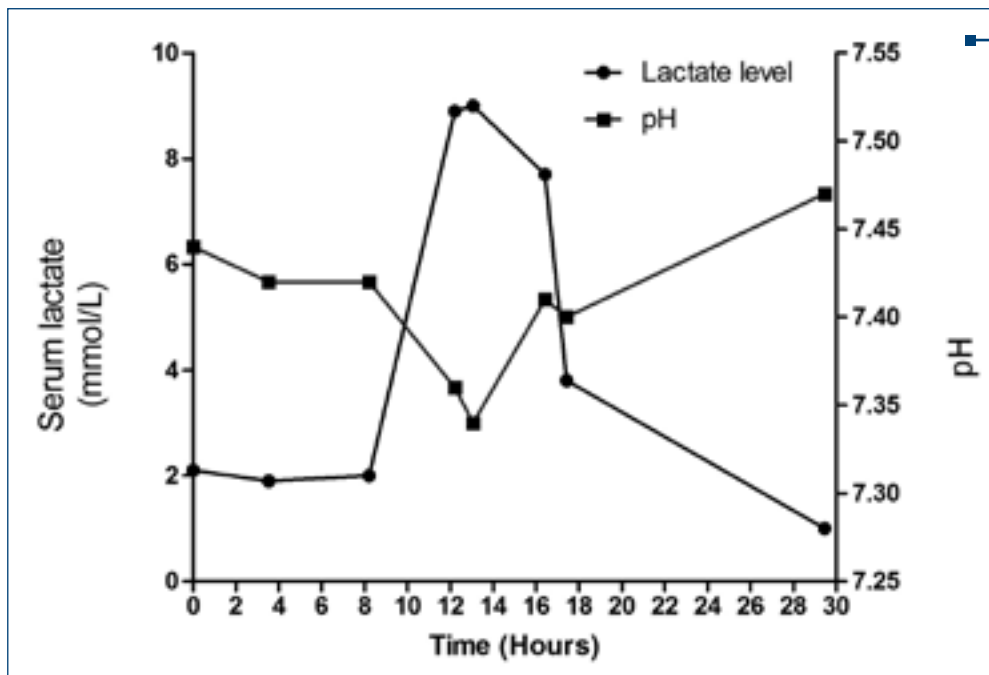


Figure 1. Albuterol-induced lactic acidosis. Serum lactate was measured using a blood gas analyzer.

(50 mg daily) and inhaled steroid/long-acting beta 2-agonist combination.

Discussion

Short-acting beta 2-agonists, such as albuterol, are the initial drugs proposed by the Global Initiative for Asthma's guidelines to use during an asthma exacerbation⁽⁶⁾. Although the pathogenesis of cardiac arrhythmias has not been fully elucidated in asthma patients, this class of bronchodilators stimulates and increases cardiac sympathetic activity and, in this way, it can affect the electrophysiological mechanisms of AF initiation and maintenance⁽²⁾. A patient with acute severe asthma has an increased risk of potentially fatal arrhythmias and ischemic heart disease due to hypoxemia, acidosis, coronary vasospasm and rise in catecholamine levels, but also by adverse effects of medications used during an exacerbation⁽⁷⁾.

Lactic acidosis during asthma status was first reported by Rees et al. in 1968⁽³⁾. Recent data has detected this condition in approximately 38% of patients with status asthmaticus⁽³⁾. Albuterol lead to derangements in glucose metabolism and subsequent development of type B lactic acidosis⁽⁸⁾. Furthermore, a significant positive correlation between albuterol plasma concentration and serum lactate values was recently reported by Lewis et al⁽³⁾. In addition, concurrent use of systemic corticosteroid may enhance the beta-receptor sensitivity leading to an increase in lactic acidosis incidence⁽⁹⁾. Finally, albuterol-induced lactic acidosis may create a paradoxical situation where there is enhanced bronchodilation but worsening tachypnea as a compensation for metabolic acidosis⁽⁹⁾.

There are diverse associations between changes of intracellular pH due to lactic acidosis and cardiac arrhythmias. Intracellular acidification may possibly lead to Na⁺ influx and further cause Ca²⁺ overload with arrhythmogenesis through activation of the Na⁺/Ca²⁺

exchanger in cells. Additionally, lactic acidosis alters the resting membrane potential, increases the amplitude of the delayed afterdepolarization and decreases beating rate in sino-atrial nodal cells⁽¹⁰⁾.

We suggest that albuterol-induced lactic acidosis creates a "perfect-storm" environment for the development of AF, even in patients without structural heart disease. While albuterol-induced lactic acidosis has not been traditionally considered a risk factor for poor prognosis, in our view, close pH surveillance in asthma patients with hyperlactatemia is warranted due to its potential arrhythmogenic effect. ■

Conflict of interest: The authors declare that they have no competing of interests.

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