

Inhaled salbutamol intoxication

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ABSTRACT

In the specialized literature, there are few cases of inhaled salbutamol intoxication, being the most used bronchodilator in children's asthma. We describe the situation of a 15-year-old teenager who inhaled salbutamol, in the context of an asthma attack, with each episode of coughing. At admission, the patient was conscious with a serious general state, afebrile, conscious, psychomotor agitation, tachycardic (heart rate=140/bpm), precordial pain, polypnea, dyspnea, with respiratory effort, hemodynamically stable, blood pressure=130/77 mmHg. Investigations showed hyperglycemia and hypokalemia. After the treatment, the evolution was favorable.

Keywords: bronchial asthma, intoxication, salbutamol

INTRODUCTION

Bronchial asthma is a heterogeneous condition whose substrate is chronic inflammation of the lower airways at the level of the lungs. Clinically, it is characterized by a history of wheezing, coughing, expiratory dyspnea, and chest tightness, which varies in intensity over time [1]. Bronchial asthma especially affects children for a long time and represents a medical emergency [2].

Salbutamol, used for the first time in 1968 by Sir David Jocs et al., is a drug used in pediatric asthma. Is a short-acting beta-2 agonist used in the treatment of bronchial asthma, in the emergency but also in the outpatient setting. It relaxes smooth muscles, inhibiting the contraction of bronchial smooth muscles, causing bronchodilatation [3].

The World Health Organization classifies salbutamol as one of the most effective and safest medications for health [4].

In children, both the inhaler and the nebulizer are used for bronchodilator therapy: the first is for home use or in mild exacerbations, and the second

for more severe exacerbations or in those who do not comply with therapy [5].

Children have a faster and more complete response during treatment with bronchodilator medication compared to adults, so salbutamol is the treatment of first choice for asthmatic children [6].

These responses are followed by an important decrease in adverse effects, an approach differing from the management in adults, which shows an increased level of tolerance present as they have more important effects at low doses [7].

Ventolin CFC-Free inhaler is a pressurized inhalation suspension that contains salbutamol and allows it to be inhaled directly into the respiratory tract. Each bottle contains 200 doses. Each dose releases salbutamol 100 micrograms in the form of micronized salbutamol 120.5 micrograms. The inhaler also contains the propellant gas CFC-Free HFA 134a (1,1,1,2 - tetrafluoroethane) [8].

The inhalation route of salbutamol is currently used because it is more effective at low doses [9,10].

CASE PRESENTATION

Teenager, aged 15 years, weight 60 kg, diagnosed with bronchial asthma at the age of 12, with numerous hospitalizations for exacerbations of bronchial asthma and acute pneumonia.

Admitted via transfer from a county hospital, transported by helicopter for a bronchial asthma crisis, during which he self-administered 1 puff of Salbutamol for each coughing episode, totaling 1 vial in 14 hours. The general condition worsens, leading to the decision to transfer.

He is admitted to the Pediatric Intensive Care Unit (PICU) of the Emergency County Clinical Hospital in Craiova with a serious general state, afebrile, conscious, psychomotor agitation, precordial pains, tachycardia (heart rate=140/bpm), polypnea, dyspnea with respiratory effort, SpO₂ = 91% with oxygen additionally, hemodynamically stable, BP= 130/77 mmHg, EKG - sinus rhythm (Figure 1), urinary catheter shows present diuresis. Emergency laboratory tests are collected (Table 1). Arterial Blood Gas analysis which reveals pH=7.2, blood glucose=124 mg % and K+=3.3 mEq/l. Cardio-pulmonary X-ray was normal. He received treatment with iv fluids with glucose and electrolytes, Metoprolol iv, Diazepam iv, Dexamethasone iv, oxygen therapy on a facial mask.

On the following day, the general condition improved, he was conscious, cooperative, hemodynamically stable, breathing spontaneously, with wheezing, pulmonary auscultation showed sibilant rales bilaterally, SpO₂ = 96% with oxygen administered by face mask, HR=115/bpm, BP= 117/66 mmHg, the abdomen was supple, painless, he received tea and yogurt. ABG analysis showed a pH = 7.43, blood glucose= 91 mg%, K+= 4 mEq/l (Table 1).

On the 4th day, he was transferred to our clinic (Pediatrics II Clinic) with an improved general state. In the clinic, the general condition is gradually im-

proving, he is afebrile, has a dry cough, intermittent wheezing, prolonged exhalation, moderate dyspnea, pulmonary auscultation without rales, SpO₂ = 90-95% without oxygen and SpO₂ = 95-98% with additional oxygen on the face mask. He received treatment with Epicocilin (Ampicillin), Hydrocortisone Hemisuccinate, Flixotide inhaler, Dexamethasone, supplemental oxygen. He also performed an allergological consultation with a diagnosis of uncontrolled bronchial asthma for which Hydrocortisone Hemisuccinate, Ventolin, Symbicort, testing for total IgE and a panel of food allergens are recommended.

TABLE 1. Investigations in dynamics

Analysis	Day 1	Day 2	Day4
pH	7.2	7.43	7.4
Lactate (mmol/l)	0.85	0.87	0.86
Blood glucose (mg/dl)	124	91	84
K (mEq/l)	3.3	4	4.2
Hemoglobin (g/dl)	15	-	-
Leukocyte (/mmm ³)	7.05	7.2	9.07
Urea (mg/dl)	0.6	0.6	0.61
CRP (ng/dl)	0.6	-	-
AST/ALT (U/L)	24/28	-	-

The teenager was discharged after 5 days of hospitalization with relatively good general condition, infrequent dry cough, vesicular murmur present bilaterally, SpO₂ = 98% without additional oxygen, HR=90/bpm, normal diuresis, without neck stiffness.

DISCUSSIONS

This adolescent, who experienced a severe adverse reaction to salbutamol, required 3 days in the Pediatric Intensive Care Unit (PICU). The patient comes from a family with no formal education,

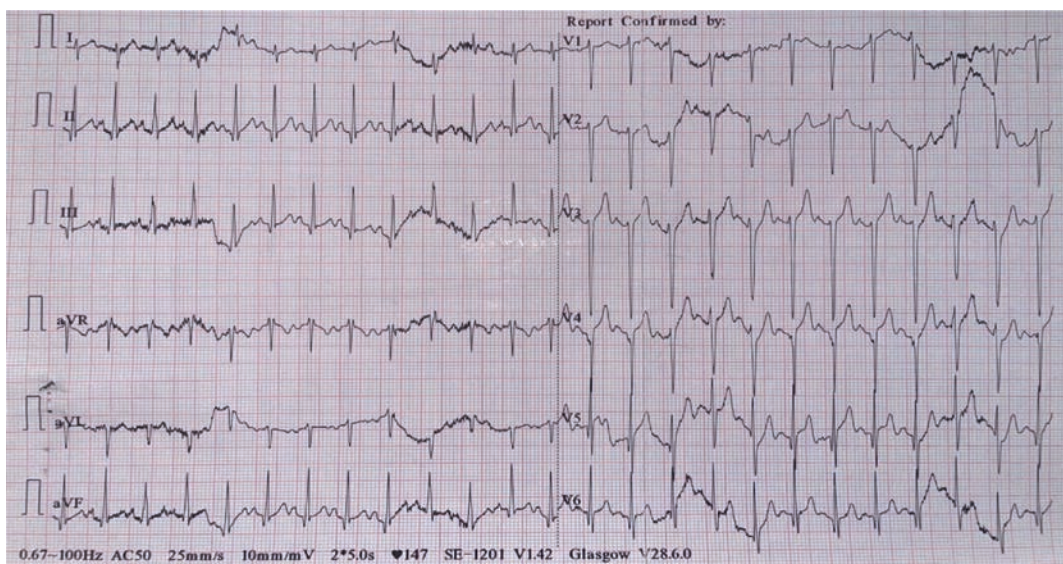


FIGURE 1. EKG result upon admission to the Pediatric Intensive Care Unit

likely unsupervised. During each coughing episode, the patient self-administered 1 puff of Ventolin, resulting in finishing the entire Ventolin vial within 14 hours.

The clinical symptoms and laboratory investigations observed in our patient were psychomotor agitation, tachycardia, precordial pain, hypertension, acidosis, hyperglycemia, hypokalemia, as described in other articles [11].

Salbutamol can lead to tachycardia, and it has been observed that inhaled salbutamol induces more tachycardia compared to the ingested quantity [11]. In salbutamol overdose, the specificity of the receptor may be lost, and beta-2 agonists can cause tachycardia, arrhythmias, myocardial depression and sudden death. Although Salbutamol is a selective beta-2 agonist, studies have shown that it has an effect on beta1 receptors in the myocardium, as both receptors are found in the myocardium [12,13].

During treatment with salbutamol, the respiratory tract may be affected, with patients experiencing chest tightness. This phenomenon has been identified as a contributing factor, in certain instances, to the emergence of airway obstruction following subsequent doses of inhaled or nebulized salbutamol [13].

The decrease in serum potassium is dependent on the activation of beta-adrenergic receptors linked to Na⁺/K⁺ ATP-ase. This enzyme is embedded in the membrane of skeletal muscle, causing an influx of potassium into cells, and subsequently leading to a decrease in the serum potassium level [2].

Salbutamol has the potential to induce hypokalemia by activating the beta-2 receptors of the Na⁺/K⁺ ATP-ase pump in skeletal muscles, triggering the movement of potassium into cells. Additionally, Sal-

butamol stimulates increased gluconeogenesis and lipolysis, leading to elevated levels of plasma glucose and the conversion of glucose into lactate and pyruvate. [9,10,12,14-16].

It has been observed in many studies that monotherapy with Salbutamol or its increased use can lead to exacerbations of bronchial asthma or acute poisoning. In this sense, in 2019, the Global Initiative for Asthma introduced an important change in the treatment of bronchial asthma, namely the fact that treatment with salbutamol alone is no longer recommended. The primary treatment for patients over 12 years of age is to receive inhaled corticosteroids and salbutamol to be used as a secondary medication [17].

In the treatment of bronchial asthma, bronchodilators are still used along with systemic therapy with corticosteroids and the administration of oxygen in a controlled flow [18].

CONCLUSIONS

1. Poisoning with inhaled salbutamol is less common in our area.
2. Our patient, although he inhaled a large dose of salbutamol, had a favorable evolution.

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