|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Volume 5, Issue 9; September: 2021; Page No.154-156

Original Research Article

THE EFFECT OF NEBULIZED SALBUTAMOL ON SERUM POTASSIUM AND BLOOD SUGAR LEVEL OF ASTHMATIC PATIENTS

Dr. Sushil Kuamr Bakolia[1], Dr Gajendra Kumar Verma[2], Dr Dinesh Kumar Barolia[3]

[1]MD (Paediatrics), Assistant Professor, Govt. S.K. Medical College & AG Hospital, Sikar (Rajasthan)

[2]MD (Paediatrics), Senior Resident, SMS Mc, Jaipur

[3]M Ch (Peadiatric Surgery, Assistant Professor, J L N Mc, Ajmer

Article Info: Received 01 August 2021; Accepted 11 September 2021
DOI: https://doi.org/10.32553/ijmbs.v5i9.2205
Corresponding author: Dr Dinesh Kumar Barolia
Conflict of interest: No conflict of interest.

Abstract

Background: To evaluate the effect of nebulized salbutamol used in the management of patients with asthma who have normal serum potassium and blood glucose levels.
Methods: Hospital based prospective study conducted on 30 children mild exacerbation of asthma who needed two doses of 2.5 mg nebulized salbutamol, 10 minutes apart for the relief of their symptoms will be include.
Results: The potassium mean was significantly decreased after 1 hour of nebulizer administration. The random blood sugar mean was significantly increased after 1 hour of nebulizer administration ($p<0.001$).
Conclusions: The nebulizer applying salbutamol has a profound effect in lowering the Potassium level and increasing blood glucose level after 60 minutes of administration.
Keywords: effect, nebulized, salbutamol, blood sugar, serum potassium

Introduction

Nebulizers are inhalation devices that use oxygen, compressed air, or ultrasonic power to break up solutions or suspensions of medication into droplets for inhalation. The aerosol is administered by a mask or mouthpiece. However, nebulizers are more expensive than pressurized metered dose inhalers, require a power source, and need regular maintenance. [1]

Adrenergic stimulation of cardiac β2ARs modulates the heart rate and contractility of the heart. In skeletal muscle, the effects of β2ARs stimulation are through a G-protein activation of adenyl cyclase which leads to elevation of cAMP and subsequent activation of protein kinase (PKA). PKA catalyzes the phosphorylation of a number of receptors within the myocytes, including ryanodine receptors and troponin, leading to increased contractility. Membrane channels and binding proteins are phosphorylated by PKA in pacemaker cells which leads to changes in the cardiac action potential through increased Ca2+ cycling.[2]

Activation of glycogen phosphorylase, phosphofructokinase, pyruvate dehydrogenase, and hormone-sensitive lipase increases substrate utilization in skeletal muscle. Furthermore, β2AR stimulation of the Na+ /K+ -ATPase pump increases intracellular concentrations of potassium and hyperpolarization of the cellular membrane. The activation of this pump consumes ATP, leading to ADP production that further drives glycolysis, resulting in increased lactate production (Andersson et al., 2012; Kalsen et al., 2014; Levy et al., 2008). β2AR agonists are known to increase membrane Na+ /K+ ATPase activity, thereby increasing intracellular [K+], decreasing intracellular [Na+], and maintaining membrane excitability and hyperpolarizing the sarcolemma [3].

The decrease in serum potassium is dose-related and potency-related, with some β2AR agonists having a more profound hypokalemic effect than other β2AR agonists, with fenoterol having a more profound hypokalemic effect than albuterol or formoterol or terbutaline. Also the β2AR agonists increase glycogenolysis and hence increase plasma glucose. This is of minor clinical importance, except in diabetic patients, whose disease is likely to be aggravated by the use of systemic corticosteroids in situations of severe asthma. The effect on glucose also shows tolerance with repeated use [4]

Material and Methods

Study design:

Hospital based prospective study

Study population:

All the children mild exacerbation of asthma who needed two doses of 2.5 mg nebulized salbutamol, 10 minutes apart for the relief of their symptoms will be include.

Sampling Method: Simple random sampling

Inclusion Criteria:

All the children mild exacerbation of asthma who needed two doses of 2.5 mg nebulized salbutamol, 10 minutes apart for the relief of their symptoms will be include.

Exclusion Criteria:

Patients who used β2AR less than four hours before admission.

Recent cardiac event (MI, angina or cardiac arrythmia).

Diabetic patients or abnormally high blood glucose at base line level.

Abnormally high serum potassium at base line.

Patients with severe dyspnea and/or respiratory failure.

Patients with renal failure.

Patients using potassium sparing diuretics e.g. Aldactone and antihypertensive drugs e.g. B.blocker, ACE inhibitor, Angiotensin II.

Results

Table 1: Socio-demographic variable

Age in yrs	10.12±2.16 Yrs
Male : Female	13 : 17
Rural : Urban	20 : 10

Table 2: Distribution of potassium and blood sugar according to three measurements

Variable	Base line	After 30 mint.	After 1 hours	p-value
Potassium	4.60±0.02	4.48±0.02	4.26±0.02	0.01
RBS	118.23±19.36	126.38±20.12	136.21±16.20	0.01

The potassium mean was significantly decreased after 1 hour of nebulizer administration. No significant changes in potassium mean were observed between baseline measurement and after 30 minutes measurement, but the potassium mean was not significantly changed between 30 minute measurement and 1 hour measurement. The random blood sugar mean was significantly increased after 1 hour of nebulizer administration. Mean RBS measurement at baseline was not significantly different from RBS measurement after 30 minutes. Similarly, RBS mean was not significantly changed between 30 minute measurement and 1 hour measurement.

The potassium mean was significantly decreased after 1 hour of nebulizer administration. No significant changes in potassium mean were observed between baseline measurement and after 30 minutes measurement, but the potassium mean was not significantly changed between 30 minute measurement and 1 hour measurement. The random blood sugar mean was significantly increased after 1 hour of nebulizer administration. Mean RBS measurement at baseline was not significantly different from RBS measurement after 30 minutes. Similarly, RBS mean was not significantly changed between 30 minute measurement and 1 hour measurement.

Discussion

For acute asthma, repeated doses of nebulized β2-agonists and to a lesser extent, IV aminophylline, is the mainstay therapies which are used to relieve bronchospasms and airway obstruction.[6] Children suffering from mild symptoms are generally treated with oral β2- agonists in the form of syrups. Only few numbers of asthmatic children had severe symptoms which required initial nebulization and steroids, followed by oral medication.It was observed in the present study, that asthmatic children receiving β2 agonists in form of the salbutamol syrup (Group2) showed a highly significant decrease in the potassium levels, as compared to (Group 2). A statistically highly significant decrease in the serum potassium levels was observed following the use of β2 agonists; the clinical significance of which is not known and warranted further study, as 5 study subjects were not presented for the follow up. This limitation can be overcome by undertaking further studies. Earlier studies also found decreased serum potassium levels to be the earliest form of electrolyte disturbance in asthma, and it was related to the use of β2-agonists. [7] Mildly decreased serum potassium levels have also been reported in untreated patients with severe asthma due to the stress of the asthmatic attacks.

There were no significant differences in the serum sodium levels in the two groups. This may be due to the fact that a maximum number of asthmatic children were having mild symptoms. In the present study, the decrease in the serum potassium levels in the group 2 asthmatic children was within normal limits, but the decrease was highly significant as compared to that in the group 1 asthmatic children. The decreased serum potassium levels may occur due to the active inhibition of potassium secretion in the cortical collecting tubule, which is possibly caused by the stimulation of the membrane sodium potassium-dependent adenosine triphosphatase that results in the hyperpolarization of the cellular membrane potential.[8] So, the use of such therapies will increase the derangement of the existing abnormal electrolyte levels. Consequently, this may pose potential cardiac and respiratory hazards in the form of myocardial depression, ventricular arrhythmia and respiratory muscle fatigue, which may consequently increase the incidence of

fatal asthma.[9] It is likely that these complications may occur especially in the presence of hypoxia or acidosis, or in asthmatic patients with preexisting cardiovascular disease. Therefore, the measurement of the serum electrolyte levels before and during the management of asthma with bronchodilators may reduce such risks, if they are corrected. [10]

Conclusion

The treatment of asthma with oral β2- agonists may lead to hypokalaemia. The inappropriate and continuous use of such drugs may also cause the hypokalaemic paralysis of the respiratory muscles. β2 agonist administration by a dry powder inhaler or by nebulization 3 times per day can be considered worthwhile, since the dose of such an administration is very less. However, this is not always feasible in small children and if the asthmatic attack is acute, repeated doses of nebulized β2 agonists are essential. Thus, the monitoring of the electrolytes with immediate correction may be warranted in asthmatic children to decrease the mortality

References

1. Bennett, J. A., & Tattersfield, A. E. (2000). Time course and relative dose potency of systemic effects from salmeterol and salbutamol in healthy subjects. Thorax, 52(5), 458-464. https://doi.org/10.1136/thx.52.5.458
2. Camargo Jr, C. A., Spooner, C., & Rowe, B. H. (2003). Continuous versus intermittent beta-agonists for acute asthma. Cochrane Database of Systematic Reviews, (4), Art. No.: CD001115. https://doi.org/10.1002/14651858.CD001115
3. Hostrup, M., Kalsen, A., Ørtenblad, N., Juel, C., Mørch, K., Rzeppa, S., Karlsson, S., Backer, V., & Bangsbo, J. (2014). Beta2-adrenergic stimulation enhances Ca2+ release and contractile properties of skeletal muscles, and counteracts exercise-induced reductions in Na+/K+-ATPase Vmax in trained men. The Journal of Physiology. https://doi.org/10.1113/jphysiol.2014.277095
4. Pandya, D., Puttanna, A., & Balagopal, V. (2014). Systemic Effects of Inhaled Corticosteroids: An Overview. The Open Respiratory Medicine Journal, 8, 59-65. https://doi.org/10.2174/1874306401408010059
5. Omar Farooq Nafea Al-Azzawi1 , Muhammed Waheeb Al. Obaidy & Doaa Mohammed Shihab. The Effect of Nebulized Salbutamol on Serum Potassium and Blood Sugar Level of Asthmatic Patients. Global Journal of Health Science;2018;10(9).
6. Hass F, Levine N, Axen K, Perelman SI. Change in serum potassium in healthy and in asthmatic subject during exercise. Am. Rev. Respir. Dis. 1998; 137: 833-6.
7. DeFronzo RA, Stanton B, Klein-Robbehaar G. Inhibitory effect of epinephrine on renal potassium secretion : a micropunture study. Am. J. Physiol. 1983; 245:303-11.
8. Philips PJ, Vedig AE, Jones Pl et al. Metabolic and cardiovascular side effects of β2 adrenoceptor agonists salbutamol and rimiterol. Br. J. Clin. Pharmacol 1980; 9: 483-91.
9. Benatar Sr. Fatal asthma. N Eng J Med 1986; 314: 423-9.
10. Crane J, Burgers CD, Graham AN, et al. Hypokalemia and electrocardiographic effects of aminophylline and salbutamol in obstructive airway disease. NZ Med J 1987; 100: 309-11.