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Original Research Paper

Effect of Salbutamol Nebulization in Serum Potassium Level in Pediatric Acute Bronchial Asthma

Medical Science

KEYWORDS : Salbutamol, hypokalemia, asthma, child health

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ABSTRACT

Introduction: *Potassium is the second most abundant cation in the body. Most of the drugs used to treat bronchial asthma, such as steroids, beta2 agonist, methyl xanthines are known to cause hypokalemia. In view of the cardiac arrhythmias that can accompany excess theophylline hypokaliemia is a serious consequence.*

Aim: *To study the role of salbutamol nebulization dosage in the serum potassium level decline and hypokalemia in children with acute bronchial asthma and its effect in recovery from the attack.*

Method: *An observational cohort study was done in Institute of Child Health and Hospital for Children, Chennai. Children 5 month to 12 years of age who are having acute attack of bronchial asthma and receiving nebulized salbutamol were screened. All patients enrolled in the study were divided into two groups by the number of nebulized salbutamol doses they received. Group I received two doses of nebulized salbutamol, Group II received three doses of nebulized salbutamol.*

Results: *In Group – I, serum potassium concentration before and after two doses of nebulized salbutamol were 3.95 ± 3.8 and 3.73 ± 0.46 respectively. The average fall being 0.27 ± 0.23. Group – II, serum potassium concentration before and after three doses of nebulized salbutamol was 3.87 ± 0.4 and 3.56 ± 0.54 respectively. The average fall being 0.3 ± 0.33*

Conclusion: *The fall in serum potassium level is high in children who received more number of doses. Nebulized salbutamol therapy is not associated with severe hypokalemia.*

Introduction

Asthma is the leading cause of chronic illness in childhood, Inhaled beta2 agonist eg: salbutamol is the first line of therapy in acute bronchial asthma followed in almost all protocols and guidelines1. In spite of improvement in treatment guidelines there is an increase in morbidity, hospital admission and mortality with bronchial asthma in children. An increasing number of sudden and unexpected deaths have been described in young patients with asthma2. Some of the deaths in children were attributed to hypokaliemia occurring as a result of salbutamol therapy. Due to increased awareness about the disease among young patients, home management of asthma with inhaled beta2 agonist has become the first line therapy. Most of the drugs used to treat bronchial asthma, such as steroids, beta2 agonist, methyl xanthines are known to cause hypokalemia. In view of the cardiac arrhythmias that can accompany excess theophylline hypokaliemia is a serious consequence. Most of the available literature deals with studies demonstrating hypokalemia in adults following salbutamol administration either systemic route or inhalational route.

Aim

To study the role of salbutamol nebulization dosage in the serum potassium level decline and hypokalemia in children with acute bronchial asthma and its effect in recovery from the attack.

Material and Methods

A descriptive study was done in Institute of Child Health and Hospital for Children, Chennai. Institutional Ethics Committee approval and informed consent was obtained. Inclusion criteria: Children 5 month to 12 years of age who are having acute attack of bronchial asthma and receiving nebulized salbutamol were screened. Exclusion criteria: Children with renal failure, grade III & IV malnutrition. Metabolic disorder, Children who received drug other than nebulized salbutamol during the study period, Children with impending respiratory arrest. Age, sex, weight, blood pressure, previous drug therapy, severity of asthma exacerbation, severity of asthma, mode of inhalation was recorded. All patients enrolled in the study were divided into two groups by the number of nebulized salbutamol doses they received. Group I received two doses of nebulized salbutamol, Group II received three doses of nebulized salbutamol. Heart rate, respiratory rate, pulmonary score, serum potassium level, Spot were recorded before and after therapy.

Results

92 children were included in this study. They were divided into two groups. Group I - 50 children who received two doses of nebulized salbutamol; Group II - 42 children who received three doses of nebulized salbutamol.

Table 1 Comparison of Serum Potassium level

Groups	n	Before nebulization	After nebulization	Mean fall in serum potassium
Group I (2 doses)	50	3.950.38	3.730.46	0.270.23
Group II (3 doses)	42	3.870.4	3.560.54	0.30.33

In Group – I, Severity of exacerbation was mild in 4 cases, moderate in 37 cases (74%) and severe in 11 cases (22%). The mean pulmonary score was 5.4 ± 1.5 which predicts PEFR between 40% - 70%. Regarding severity of asthma mild intermittent was 16 (32%) mild persistent was 30 (60%) and moderate persistent was 4 (8%). The mean ± SD

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serum potassium concentration before and after two doses of nebulized salbutamol were 3.95 ± 3.8 and 3.73 ± 0.46 respectively. The average fall being 0.27 ± 0.23 (P<0.05; paired t-tests). fall in serum potassium was seen in 39 patients. The ranges of fall in these children were 0.1 to 1 mmol/1. Hypokalemia was observed in 15 children. 3 children had hypokaliemia previously while 12 children developed it after receiving two doses of nebulized salbutamol. No patient developed severe hypokalemia. In Group – II, Severity of exacerbation was moderate in 32 cases (76%) and severe in 10 cases (24%). The mean pulmonary score was 6 ± 1.4 which predicts PEFR between 30% - 60%. Regarding severity of asthma mild intermittent was 13 (3110), mild persistent was 25 (60%) and moderate persistent was 4 (9%). The mean ± SD serum potassium concentration before and after three doses of nebulized salbutamol was 3.87 ± 0.4 and 3.56 ± 0.54 respectively. The average fall being 0.3 ± 0.33 (P<0.05; paired t-tests). A fall in serum potassium was seen in 34 (81%) patients. The range of fall in these children was 0.1 to 1.1 mmol/1.

Table 2 Comparison of both groups observation

		Group I (50)	Group II (42)
1	Age	3.93.1	4.22.78
2	Sex Ratio	2:1	2:1
3	Severity of asthma		
	Mild intermittent	16 (32%)	13 (31%)
	Mild persistent	30 (60%)	25 (60%)
	Moderate persistent	4(8%)	4 (9%)
	Severe persistent	0 (0%)	0 (0%)
4	Severity of acute exacerbation		
	Mild	2(4%)	0 (0%)
	Moderate	37(74%)	32 (76%)
	Severe	11(22%)	10 (24%)
5	Heart rate / min	117 =15	11112
6	Respiratory rate / min	481.5	5411.5
7	Pulmonary score	5.41.5	61.4
8	Hypokaliemia (<3.5 mmol/1)	30%	40%
9	Fall in serum potassium	0.27+0.23	0.30.33

In group II, Hypokalemia was observed in 17 children; 5 children had hypokalemia previously while 12 children developed it after receiving three doses of nebulized salbutamol. 1 patient developed severe hypokaliemia (<2.5mmo1/1). Though all children showed an increase in heart rate which is within physiological limit, no child showed any disturbance of rhythm.

Table 3 Effect in Recovery

Group Serum Potassium ≤3.5 m.mol/1		Pulmonary Score	
		Serum Potassium >3.5 m.mol/1	
Group I	Before Nebulization	5.2 1.5	5.31.5
	After Nebulization	0.66 0.7	0.940.6
Group II	Before Nebulization	6 1.3	61.5
	After Nebulization	1.35 0.8	1.760.6

Group I and II, children who developed hypokalemia had better clinical recovery than those with normokalemia (assessed by pulmonary score)

Discussion

In children who received two doses of nebulized salbutamol Group I, the fall being 0.27 ± 0.23 and in children who received three doses of nebulized salbutamol Group II, the fall being 0.3 ± 0.33.

Table 4 Comparison of this study Vs Other studies

S. Potassium	Hall bloon et al.,[3]	S. Singhi et al.,[4]	Our Study
Before Nebulization	-	3.90.5	3.870.4
After Nebulization	-	3.70.5	3.560.54
Mean fall	0.50.3	0.20.6	0.30.33

The study conducted in adults by Hall bloom et al3, observed that an average fall of 0.3, 0.5, 0.9 mmol/1 in serum potassium level with increasing dose of beta2 agonist given by inhalation. The study done by Rohr AS et al5,' observed an average fall of 0.9 mmol/1 following intravenous administration of salbutamol. Chandigarh study done by Singhi et al4, 45 observed a fall in serum potassium with an average of 0.2 ± 0.6 m mo1/1 with three doses of nebulized salbutamol. The trend in our study is similar to that seen in adults but as with the Singhi et al4 study the hypokalemic effect appears to be much milder. (Table - 4). Compared to adults the muscle mass and inturn body K+ content is less (at 10 years body K+ content is 37 mmol/kg, at 20 years it is 58 mmol/kg.6) in children. So less amount of potassium is pumped into the cells with given dose of salbutamol producing a milder effect in children.

Table 5 Incidence of Hypokalemia

Sl.No.	Group	Number	Percentage
1	Group – I (50)	15	30
2	Group – II (42)	17	40
3	Singhi. S. et al[4], (46)	18	37.5

Hypokaliemia was observed in 30% of the children in group - I, 40% of the children in group - II as compared to 37.5% of children in Singhi et al4 study. The intra cellular shift of potassium causes hyperpolarization of cell membrane and predisposes the patient to increased risk of cardiac arrhythmias. But in our study the marginal fall in potassium was not accompanied by any change in heart rate or rhythm. In both group hypokalemia and normokalemia patient did not differ in respect to age, sex, severity of the attack, severity of asthma. Children who developed hypokalemia had better clinical recovery than those with normokalemia (assessed by pulmonary score) (Table - 3). But Singhi et al4 study observed that average time taken for clinical recovery was longer by 2 hours in patients who developed hypokaliemia as compared to those with serum potassium concentration above 3.5 m moll. They attributed the delay to respiratory muscle weakness caused by hypokalemia. But Hung CH et al7, correlated hypokaliemia with clinical recovery and bronchodilatation as observed in our study. The frequency of hypokalemia in our children graded as having severe exacerbation was not higher although the stress of acute illness is known to predispose a lowering of serum potassium concentration because of raised endogenous circulating adrenaline levels. However frequency of hypokaliemia before treatment in group I was 6% compared to 12% in group II.

Conclusion:

Nebulized salbutamol therapy for treatment of an acute attack of bronchial asthma is accompanied by a small though fall in serum potassium level. The fall in serum potassium level is high in children who received more number of doses. Nebulized salbutamol therapy is not associated with severe hypokalemia. No children required any treatment for hypokaliemia.

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