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Original Research Article

Evaluation of abnormal serum electrolytes in asthmatics

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Abstract

Background and Objectives: Airway inflammation and hyper reactive bronchial tissue are hallmarks of bronchial asthma. The purpose of this study was to compare the blood serum electrolyte values of patients with asthma to those of a healthy population in order to establish if there is a distinction between those with intermediate asthma and those with persistent asthma.

Methods: This case-control study focused on asthma patients treated at Department of Respiratory Medicine, Mamata Medical College and General Hospital, Khammam, Telangana, India. Twenty patients with both mild and severe cases of asthma were randomly assigned to groups with healthy sex-and age-matched subjects, and both groups were monitored for six months. No attempt was made to determine if secondary electrolyte disturbances might have been involved. Serum blood samples could be analysed to reveal sodium, potassium, magnesium, calcium and phosphorus levels.

Results: The results showed that those with sporadic symptoms were significantly different from those with persistent symptoms (P 0.001). The prevalence of hypomagnesemia and hypokalemia was highest in the persistent and intermittent asthma groups, respectively, in the asthma patient population. The effects of low sodium, calcium, and phosphorus levels were negligible.

Conclusion: Asthma patients tend to have abnormal concentrations of sodium, potassium, magnesium, calcium, and phosphate, the study's authors concluded. Asthma patients typically had low magnesium levels and high potassium levels. Overall, the serum potassium, sodium, and magnesium levels were found to be higher in the group with intermittent asthma than in the group with persistent.

Keywords: Asthma, hyponatremia, electrolytes, hypophosphatemia, hypokalemia, hypomagnesemia

Introduction

When it comes to chronic airway inflammation, asthma is a disease that can strike at any time. Patients, their loved ones and the entire community bear the brunt of this. It is caused by a combination of molecular factors and environmental cues. The most widespread environmental hazards include toxins in the air, an excessive consumption of salt, indoor allergens, medications and vaccinations. Without prompt medical attention, respiratory symptoms can be fatal. It is estimated that 30 million Indians, or 1 percent of the world's population, suffer from asthma. Daily activities, lung function, quality of life, and societal

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costs are all impacted by asthma. Asthma accounts for one percent of all global disease burden, claiming 150 lakh life years annually. Children have an estimated 3-38 percent prevalence of asthma, while adults have an estimated 2-12% prevalence. A study found that 2.05 percent of Indians over the age of 15 suffer from asthma, totalling 18 million people with the condition [1, 2, 3].

Many people with asthma exaggerate their ability to manage their condition. 67% of people with asthma in India have experienced an exacerbation, which can lead to serious difficulties with breathing and other aspects of daily life. It demonstrates how poorly patients are able to control their asthma and how they do not adhere to their treatment. Bronchodilators, inhaled corticosteroids, and influenza vaccinations are used in low-income countries like India. Acute bronchospasm is associated with an increased risk of cardiac arrhythmias due to the acidosis and hypoxemia induced by beta-adrenoceptor agonists and other sympathomimetic bronchodilators [4, 5, 6]. Serum potassium levels are commonly abnormal in asthmatics taking beta 2-agonists. Hypokalemia was the first electrolyte abnormality seen in patients with acute asthma and was caused by treatment with beta 2-agonists and aminophylline. Beta 2 agonists frequently cause unwanted side effects like tremors, tachycardia, palpitations, and anxiety. Asthmatics treated with beta 2 agonists eventually experienced low levels of magnesium, phosphorus, and calcium in their blood [7, 8, 9].

The increasing death rate is largely attributable to the negative effects of using beta 2-agonists to treat acute asthma. Deaths from asthma spiked in the 1970s, when non-selective beta 2-agonists like isoproterenol and fenosterol were widely used. Arrhythmias may result from a deficiency in potassium, magnesium, or calcium. If acute severe asthma sufferers already have hypophosphatemia, that condition could become even more severe. Symptoms of intermittent asthma occur less frequently than once per week and less frequently than twice per month, as defined by the Global Initiative for Chronic Obstructive Airway Diseases (GINA). Persistent asthma has >1 weekly and >2 monthly nocturnal symptoms. There is a dearth of high-quality clinical research on the topic. The purpose of this research is to determine whether or not the electrolyte levels of people with intermittent versus persistent asthma are different [9, 10, 11].

Materials and Methods

Patients who received routine medical care at the Department of Respiratory Medicine, Mamata General Hospital outpatient department in Khammam, Telangana, India, were the study's case and control groups. 88 patients were evenly divided between 52 control and 52 case groups from November 2021 to October 2022. (20 intermittent and 20 persistent asthmatic cases).

Inclusion criteria

1. Intermittent asthmatics and severe asthmatics were divided into two groups at Mamata General Hospital, Respiratory Medicine outpatient department and casualty (persistent asthmatics).
2. 18-60 years old.
3. Asthma-free people.

ISSN 2515-8260 Volume 10, Issue 01, 2023

Exclusion criteria

1. History of cardiovascular disease, diabetes, alcoholism, chronic kidney disease, diarrhoea, pregnancy, or diuretics or bronchospasm medications.
2. Those not joined.

Methodology

After being fully informed, participants consent. A structured proforma collected data. Methods included age, sex, occupation, a comprehensive medical history with weekly and monthly symptom frequency, clinical examinations, and relevant investigations.
Ages, sexes, religions, blood pressures, and clinical chemistry variables were collected. Each participant had two millilitres of blood drawn into clot activator Vacutainers for infection control. Centrifuged blood at 2500 rpm for five minutes yielded serum. Serum samples were analysed for sodium, potassium, magnesium, calcium, and phosphorus. Calculating sodium/potassium concentrations (Ion selecting electrode method).
Electrolytes affect every metabolic pathway. They maintain osmotic pressure, hydrate fluid compartments, control pH, and maintain heart and muscle function. Enzyme and oxidation-reduction reactions require electrolytes as cofactors. Excel received the data. Calculated percentages, means, and standard deviations. Other significance tests included the independent students' t-test and Fisher's exact test. $p < 0.05$ indicated statistical significance [11, 12, 13].

Results

The purpose of this investigation was to determine how significant a potential electrolyte abnormality is in asthmatic patients. 52 people with asthma were considered, split into two groups of 20 with the other 52 serving as healthy controls.

General characteristics of the study population

Table 1: Age

Age	Control		Case	
	Number	Percentage	Number	Percentage
18 to 20 years	1	2	5	10
21 to 30 years	8	15	8	15
31 to 40 years	10	19	6	12
41 to 50 years	12	23	15	29
51 to 60 years	21	40	18	35
Total	52	100	52	100

Table 2: Study sample distribution

Age	Number	Mean	Std. Deviation
Control	52	45.56	12.53
Intermittent	20	44.59	14.83
Persistent	20	44.59	12.9

There are 5 categories for the cases and controls (18 -20years, 21-30yrs, 31-40yrs, 41-50yrs, and 51-60yrs). As can be seen, the majority of cases are between the ages of 51 and 60 (38%) and the majority of controls are between the ages of 51 and 60 (43%). The mean ages of the

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control group and the intermittent and persistent cases are both listed in Table 2 at 45.56 and 44.59 years, respectively. The study included people of varying ages, with the youngest being 18 and the oldest being 60. The mean age was 44.1.

Table 3: Sex Distribution

Sex	Control		Case	
	Number	Percentage	Number	Percentage
Male	31	60	24	46
Female	21	40	28	54
Total	52	100	52	100

The control group consisted of 52 people: 31 men (60%) and 21 women (40%), while the case group was skewed more towards women: 28 of them (54%) and men (46%).

Table 4: Distribution of Electrolyte parameters

	Hyponatremia		Hypokalemia		Hypomagnesemia		Hypocalcaemia		Hypophosphatemia	
	n	%	n	%	n	%	n	%	n	%
Control (52)	15	29	0	0	4	8	31	60	0	0
Intermittent (20)	17	85	11	55	19	95	18	90	20	100
Persistent (20)	20	100	20	100	19	95	18	90	20	100

Both case and control groups had abnormal electrolytes, as shown in Table 4. The persistent group has no hyponatremia, while the intermittent and control groups have a significant percentage. The persistent group had 100% prevalence, while the intermittent and control groups had 10% and 0%, respectively. The constant and non-constant groups have 100% frequency. This study found hypocalcaemia in 90% of the population. The intermittent, persistent, and control groups all have hypophosphatemia.

Serum sodium levels in controls and cases

People with (intermittent and persistent) hypertension have higher mean serum sodium levels (p<0.05) than those without it. Cases that change and those that don't differ statistically.

Table 5

	N	Mean	Standard Deviation (±)	P value
Control	52	136.54	2.56	
Case-I	20	134.63	0.9	0.001

Table 6

	N	Mean	Standard Deviation (±)	P value
Control	52	136.54	2.56	
Case-P	20	132.72	1.93	<0.0001

Table 7

	N	Mean	Standard Deviation (±)	P value
Case - I	20	134.63	0.9	
Case - P	20	132.72	1.93	<0.0001

Serum potassium levels in controls and cases

The mean serum potassium levels of individuals with (intermittent and persistent) cases differ from those of people without cases (p<0.05). Cases that come and go differ statistically from

those that stay the same.

Table 8

	N	Mean	Standard Deviation (±)	P value
Control	52	4.37	0.53	
Case-I	20	3.89	0.89	0.008

Table 9

	N	Mean	Standard Deviation (±)	P value
Control	52	4.37	0.53	
Case-P	20	3.22	0.19	<0.0001

Comparison of serum Magnesium between controls and cases. The mean serum magnesium levels of people with (intermittent and persistent) cases and those without cases differ statistically (p<0.05). Cases that change and those that don't differ statistically.

Table 10

	N	Mean	Standard Deviation (±)	P value
Control	52	1.96	0.22	
Case - I	20	1.44	0.15	<0.0001

Table 11

	N	Mean	Standard Deviation (±)	P value
Control	52	1.96	0.22	
Case-P	20	1.32	0.62	<0.0001

Table 12

	N	Mean	Standard Deviation (±)	P value
Case-I	20	1.44	0.15	
Case-P	20	1.32	0.62	0.392

Comparison of serum Calcium between controls and cases

There is a statistically significant difference (P>0.05) between the mean Serum Calcium levels of people with (intermittent and persistent) cases and people without cases. There is no statistically significant difference between cases that come and go and cases that stay the same.

Table 13

	N	Mean	Standard Deviation (±)	P value
Control	52	8.55	0.69	
Case-I	20	7.7	0.67	<0.0001

Table 14

	N	Mean	Standard Deviation (±)	P value
Control	52	8.55	0.69	
Case-P	20	8.01	0.74	0.005

ISSN 2515-8260 Volume 10, Issue 01, 2023

Table 15

	N	Mean	Standard Deviation (±)	P value
Case-I	20	7.7	0.67	
Case-P	20	8.01	0.74	0.152

Comparison of serum phosphorus between controls and cases

Between (intermittent) cases and controls, there is a statistically significant difference (p<0.05) in the mean level of Serum Phosphorus. There is no statistically significant difference between cases that come and go and those that stay the same.

Table 16

	N	Mean	Standard Deviation (±)	P value
Control	52	4.24	0.57	
Case-I	20	2.29	0.1	<0.001

Table 17

	N	Mean	Standard Deviation (±)	P value
Control	52	4.24	0.57	
Case-P	20	2.29	0.27	<0.001

Table 18

	N	Mean	Standard Deviation (±)	P value
Case-I	20	2.29	0.1	
Case-P	20	2.29	0.27	1

Distribution of electrolytes between cases

Table 19

	Hyponatremia		Hypokalemia		Hypomagnesemia		Hypocalcaemia		Hypophosphatemia	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Intermittent	18	2	12	6	20	0	20	0	20	0
Persistent	19	1	19	1	20	0	18	2	19	1
p-value	0.345		0.021		N/A		0.488		1	
significance	NS		S		S		NS		NS	

In Table 19, intermittent and persistent asthmatics' electrolytes are distributed. In the intermittent and persistent groups, hypernatremia, low calcium, and low phosphate were similar. Hypokalemia is widespread, as is low magnesium.

Discussion

Bronchial asthma affects babies, children, and adults. Breathing, wheezing, and coughing characterise this complex disorder. Nighttime, hard exercise, or irritation cause coughing. Different people have different causes for all symptoms. Bronchitis symptoms may disappear between bouts. Many factors cause bronchial asthma, which inflames, blocks, and makes breathing difficult. Improving early childhood (puberty). Zein JG *et al*. found that asthma severity increases with age between 18 and 45. Asthma in children is less severe than in adults.

Asthma is treated symptomatically using GINA. Oral or inhaled beta agonists or corticosteroids relieve symptoms. Early detection and treatment reduce disease severity. This

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study compared asthmatics with persistent and intermittent electrolyte issues. Intermittent asthmatics have mean serum sodium levels of 134.63 +0.9 mEq/L and persistent asthmatics 132.72 +1.93. Serum sodium is below the control group's mean of 136.54+2.56 mEq/L. Patients who change have higher serum sodium levels. Intermittent and persistent hyponatremia groups differed greatly from controls. Intermittent-persistent was unimportant. 136-145 mEq/L. Theophylline can cause hyponatremia by dehydrating you [14, 15, 16].

Intermittent asthmatics have 3.89+ 0.89 mEq/L serum potassium, while long-term asthmatics have 3.22+0.19. Control group patients have a mean serum potassium level of 4.37 0.53 mEq/L, higher than intermittent and long-term asthmatics. 3.5-5.1 mEq/L. Intermittent patients have better serum potassium levels than persistent patients. Statistics linked the groups. Asthmatics had lower blood potassium, according to Whyte KF. Whang et al. found that magnesium deficiency slows Na/K ATPase and increases K channel efflux. Urine excretes potassium. Short-term and long-term asthma patients have mean serum magnesium levels of 1.44+0.15 mg/dl and 1.32+0.62 mg/dl. Control magnesium is 1.96+0.22 mg/dl. Serum magnesium should be 1.7-2.4 mg/dl. Intermittents' mean serum magnesium levels are closer to normal than persistents'. Important statistically. All 44 asthmatics had low magnesium. Asthmatics have low blood magnesium and phosphate levels, according to Alamoudi OS [15, 16].

Intermittent asthmatics have 7.7+0.67 mg/dl serum calcium, while long-term asthmatics have 8.01+0.74 mg/dl. Comparing intermittent and persistent asthmatics to the control group is statistically important. Both groups lacked calcium. 8.6-10.3 mg/dl. Healthy IV 2-agonist users lost calcium. Serum phosphorus is 2.29+0.1 mg/dl in intermittent asthmatics and 2.29+0.27 in persistent asthmatics. Control group mean: 4.24+0.57 mg/dl. Control group mean values affect persistent and intermittent asthmatic mean values. Asthma groups shared little. 2.5-4.5 mg/dl. Asthmatics have low blood magnesium and phosphate levels, according to Alamoudi OS [17, 18].

In 23 asthmatic or COPD patients, aggressive nebulized Salbutamol treatment for acute bronchospasm decreased serum Potassium, Magnesium, and Phosphorus, according to Denver General Hospital emergency medical services. 14 asthmatics who used long-acting beta agonists and inhaled corticosteroids at Calcutta National Medical College had low magnesium levels and trouble breathing. In a Karnataka study of 60 asthmatics given nebulized salbutamol, serum electrolytes like magnesium, potassium and phosphorus dropped significantly [19, 20].

Conclusion

Calcium, phosphorus, magnesium, sodium, and potassium levels are being measured. As was to be expected, people with asthma had abnormally low levels of several electrolytes. Different electrolyte abnormalities were found in asthmatics. The study found a low calcium level (less than 8.5mg/dl), but it was not statistically significant. Hypernatremia doesn't even matter. Research into bronchial asthma caused by dust or allergens was conducted in Kulasekharam, a town in southern India known for its rubber trees and stone workshops.

Serum electrolyte levels were found to be abnormal in the studies. This study found that electrolyte levels were higher in patients with intermittent asthma who only required medication on occasion. Hyponatremia, hypokalemia, hypomagnesemia, hypocalcemia, or hypophophatemia were found in asthmatics. Patients with asthma had significantly lower magnesium levels. The levels of potassium, sodium and magnesium in the bodies of people with intermittent rather than chronic asthma are higher.

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