ejpmr, 2015,2(5), 562-568.

SJIF Impact Factor 2.026

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 3294-3211

EJPMR

PREVALENCE OF ELECTROLYTE DISTURBANCES IN ACUTE EXACERBATION OF BRONCHIAL ASTHMA

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Article Received on 06/07/2015 **Article Revised on 30/07/2015** **Article Accepted on 23/08/2015**

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ABSTRACT

Aims: This study is to determine the prevalence of electrolyte disturbances during acute exacerbation of bronchial asthma and after standard treatment. **Methods:** Total 50 patients who met the inclusion criteria as; age over 16 years, asthma history, and an acute exacerbation were included. Treatment started according to GINA (Global INitiation of Asthma) protocol. Serum electrolyte levels were measured at intervals of 0 min, 90 minutes and 180 minutes and followed up to discharge. **Results:** Electrolyte disturbance at the time of admission was found in 27 patients (54 %);the highest proportion was Hyponatremia 16(32%),followed by Hypomagnesemia 15(30%).After standard treatment decrease in all electrolytes level was noted. Maximum drop in magnesium and potassium levels were noted at 90min,sodium and phosphorous levels at 180min.Severity of asthma was statistically and clinically significant with hypomagnesemia(P=0.04).Other electrolyte disturbances noted were not clinically significant. **Conclusion**: Each patient with acute exacerbation of asthma, should be screened for electrolytes disbalance, as it can alter the course of disease progression. As low serum Magnesium level is associated with more severe asthma attack,serum magnesium level should be checked during admission and at least after 2 hours of nebulisation.

KEYWORDS: Hyponatremia, nebulization, bronchial, Global INitiation of Asthma.

INTRODUCTION

Bronchial asthma is one of the most common diseases globally and it currently affects approx. 300 million people. Asthma is a very common disease with immense social impact, with a prevalence of around 10-12% in adults and 15% in children. It is known to occur at all ages, with a slight male preponderance.[1]

Asthma is a multifactorial disease with atopy as single largest risk factor. Other risk factors include genetic factors, pharmacological stimuli, environmental factors, occupational factors, infections, exercise and emotional stress.[2]

Avoidance of allergen and desensitization are less successful modes of treatment. Drug therapy is the most commonly used mode of treatment for asthma. The drugs which are used to treat asthma are β_2–adrenergic agonists, methyl xanthines, glucocorticoids and mast cell stabilizing agents. β_2–Adrenergic agonists have been the primary focus of the emergency management of acute severe asthma for over 50 years.[2,3]

The administration of nebulised salbutamol during the emergency treatment of acute severe asthma was shown to be associated with a significant decrease in serum magnesium, potassium and phosphate levels.[3,4]

Few earlier reports showed an association between magnesium deficiency and increased airway hyperreactivity, pulmonary vascular resistance, and ventricular arrhythmia.[5,6] Treatment with ß$_2$-agonists can reduce serum magnesium levels through urinary loss or intracellular shift.[7]

Recently, hypomagnesemia (serum level >0.74mmol/L) was found to be a common disorder in patients with chronic asthma.Although the cause of hypomagnesemia in patients with chronic asthma was unknown, asthmatic patients with low serum magnesium levels were found to have more severe asthma and a higher incidence of asthma exacerbation and hospitalization than asthmatic patients with normal serum magnesium levels.[8] Some earlier reports showed an association between magnesium deficiency and increased airway hyperreactivity, pulmonary vascular resistance, and ventricular arrhythmia.[5,6]

Tremors, tachycardia, palpitation, and anxiety are well-known side effects of ß2-agonists[9] Hypokalemia, Hypomagnesemia and Hypocalcaemia are wellknown causes of cardiac arrhythmia[10,11] Hypophosphatemia can worsen even respiratory failure in acute severe asthma through impairment of respiratory muscle performance.[12] There are only few studies related to above subject and its clinical relevance. Therefore, the present study was carried out to assess the prevalence of electrolyte disturbances in patients presenting with acute asthma and its relation to severity and to assess whether the therapeutic agents used to treat acute asthma have any effect on electrolyte levels and its clinical significance.

MATERIALS AND METHODS

This prospective Study was carried out on patients who were admitted to Dhiraj General hospital(pipariya) with acute exacerbation of asthma from july 2013 to August 2014. A total of 50 subjects were selected after they gave consent to participate in the study. Spirometrically and clinically confirmed cases of asthma were taken into study. The severity was assessed based on GINA guidelines.Chest X-ray, ECG, ABG, Haemogram, and other routine investigations were done. Salbutamol nebulisation was given at admission (0 min) and repeated at every 30 min intervals for first 2 hrs and then every fourth hourly up to 24 hrs and then repeated according to need. Serum electrolyte levels were measured at the time of admission (0 min), 90 minutes and 180 minutes after the nebulisation.The Excel and SPSS 10.5 (SPSS Inc, Chicago) software packages were used for data entry and analysis.The results were averaged (mean + standard deviation) for each parameter for continuous data and numbers and percentage for categorical data are presented in Tables. The student 'T' test was used to determine whether there was a statistical difference between male and female subjects in the parameters measured. Proportions were compared using Chi-square test.One-way analysis of variance was used to test the difference between groups. In all the above tests a “p” value of less than 0.05 was accepted as indicating statistical significance. In this study among 50 patients 58 % were female and 42% were male. Overall mean age was 54 ± 18 years. Mean age of onset was 28 ± 16 yrs. Severity of exacerbations were not statistically significant with respect to age (p value=0.182) and gender (p value=0.760). Electrolyte disturbance at the time of admission was found in 27 patients (54 %). Among them 18 (66.7%) patients had single electrolyte disturbance and 9(33.4%) had two electrolyte disturbances as shown in Table-1.With respect to individual variation in electrolyte disturbance incidence of Hyponatremia was relatively high as shown in Table 2 [16(32%),followed by magnesium 15(30%), potassium 4(8%) and phosphorous 4(8%)].

Changes in Sodium, Potassium, Magnesium and phosphorous levels at various intervals with nebulisation :The changes in sodium, potassium, magnesium and phosphorous levels at various intervals are shown in table-3 .16(32%) asthmatic patients were found to have low serum sodium level (< 135 mmol/L). This number increased to 19(38%), & 23(46%) after 90min and 180min of onset of treatment respectively.Maximum decrease in mean concentration of sodium was noted at 180min (by 0.74l mmol/L).In the present study hypokalemia (<3.5meq/l) was found in 4(8%)of paients,it increased to 13(26%) and 9(18%) at 90 min and 180 min after onset of nebulisation.Maximum drop in potassium level was

noted at 90min (by 0.162meq/l).However no clinical manifestations of hypokalemia were noted during the study.Hypomagnesemia (<1.8mg/dl) was found in 15(30%) of patients and it increased to 22(44%) and16(32%) at 90min and 180min.Maximum drop in magnesium level was noted at 90 min (by 0.162mg/dl). In 2 cases of severe hypomagnesaemia recovery delayed, first patient discharged after 6 days, second patient was ventilated and recovered with magnesium correction and discharged on 10th day.Multiple logistic regression analysis showed significant association of severity of asthma with hypomagnesaemia (p=0.04).Hypophosphatemia <2.5mg/dl(<0.8mmol/l) has also been reported in patients with acute asthma. Hypophosphatemia was seen in 4(8 %) of patients and it decreased to 3(6%) and 3(6%) cases at 90 min and 180 min.Maximum drop in phosphorous level was noted at 180min (0.240 mg/dl).The changes in electrolytes level at various intervals are not statistically significant (p value-0.605). Mean duration of hospital stay was 4 days;maximum number 24(48%) patients discharged on 3rd day.By 4th day 43(86%) patients were discharged.Number of days of hospital stay was statistically significant with respect to severity (p value=0.001) as shown in Table-4.

Table 1: Number of Electrolyte disturbances at admission

Proportion of electrolyte disturbances at admission	Percentage%
One electrolyte disturbance	18(66.7%)
Two electrolyte disturbance	9(33.3%)
Three electrolyte disturbance	0(0%)
Total	27(54%)

Table 2: Proportion of Electrolyte disturbances at admission

Type of Electrolyte disturbances	Percentage%
Hyponatremia	16(32%)
Hypomagnesemia	15(30%)
Hypokalemia	4(8%)
Hypophosphatemia	4(8%)

Table 3: Changes in analytes level at different intervals after nebulisation

Time after nebulisation	Sodium (mg/dl)	Potassium (mg/dl)	Magnesium (mg/dl)	Phosphorous (mg/dl)
0-min	135.38 ± 3.752	4.004 ± 0.431	1.970 ± 0.359	3.646 ± 0.866
90-min	134.90 ± 3.3030	3.842 ± 0.466	1.808 ± 0.334	3.426 ± 0.697
180-min	134.64 ± 3.1540	3.928 ± 0.452	1.906 ± 0.364	3.408± 0.766

Table 4: Mean Hospital Stay according to Severity

Severity	No.of cases	Mean hospital stay(days)	Std. Deviation	Minimum	Maximum
Mild	14	2.71	0.611	2	4
Moderate	28	3.29	0.600	2	4
Severe	8	6.00	1.852	4	10

***'P' value <0.001**

DISCUSSION

Electrolyte disturbance at the time of admission was found in 27 patients (54 %) out of 50 patients.As compared to other studies {Keng Leong Tan et al[13] Alamoudi et al[14]}, two electrolyte disturbances 9(33.3%) are more in the present study than three electrolyte disturbances.This study showed high prevalence of hyponatremia at admission & increased incidence of hyponatremia with treatment.However these changes did not show any clinical and statistical significance (p value=0.605).No previous studies drew a clear conclusion about prevalence and clinical significance of hyponatremia.Hence further studies are needed to evaluate the significance of this finding.

The changes in potassium levels at various intervals are not statistically significant (p value >0.05).Hence therapeutic drugs administered for the management of acute asthma (nebulised bronchodilators, IV hydrocortisone) might found to have decremental effect on the serum potassium level but not clinically significant to cause signs and symptoms of hypokalemia.This study showed high prevalence of hypomagnesemia at admission & increased incidence with treatment and statistically and clinically significant association with severity of asthma.In the present study there was no change in incidence of Hypophosphatemia after nebulisation.Present study is consistent with study done by Bodenhamer et al.[4]

The highest proportion of electrolyte disturbance was found for sodium 16(32%), followed by magnesium 15(30).Following treatment maximum drop in sodium level was noted at 180min (by 0.74 meq/l),in magnesium level at 90min (by 0.162 mg/dl),in potassium level at 90min (by 0.162 meq/l) and in phosphorous level at 180min (by 0.240 mg/dl).Multiple logistic regression analysis showed that severe asthma was associated significantly with hypomagnesaemia(p value=0.04) with two patients showing clinical manifestations of

hypomagnesemia.Other electrolyte disturbances noted during study were not associated with any clinical complications.

Care should be taken to avoid the adverse effects of bronchodilator therapy.If low levels of electrolytes are found on admission, bronchodilator therapy with β_2-agonists may 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 consequently may increase the incidence of fatal asthma.Extra care should be taken if underlying hypoxia or acidosis or preexisting cardiovascular disease and electrolyte disturbances noted during admission.

CONCLUSION

Electrolyte disturbances are common in acute asthma.Hypomagnesaemia and hyponatremia were found to be the most common electrolyte abnormalities in our study. Therefore, Serum electrolytes level should be checked during admission and at least after 2 hours of nebulisation (especially for patients who have dyselectrolytemia at admission),since maximum fall in electrolytes level noted with in this period.As Hypomagnesaemia was significantly associated with severe asthma attack, checking Magnesium level during admission and after 2 hours of nebulisation is more important.However,further studies are needed to confirm our findings and to clarify these speculations.

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