

Status Trace Elements of Zinc, Magnesium and Calcium Electrolytes in Serum among Stable Chronic Persistent Asthma in Tehran

Khosrow Agin¹, Maryamossadat Moinazad Tehrany²

1- Associated Professor of Pulmonary Medicine, Loghman Hakim Teaching Hospital, ShahidBeheshti University of Medical Sciences, Tehran, Iran.

2- Assistant Professor of Pulmonary Medicine, Loghman Hakim Teaching Hospital, ShahidBeheshti University of Medical Sciences, Tehran, Iran.

Corresponding author: Khosrow Agin, Loghman Hakim Teaching Hospital, South Karegar Ave, Tehran, (IR)Iran.

Emails: Agin@sbmu.ac.ir & khosrow.agin@yahoo.com

Abstract

Background: Bronchial asthma (BA) is a chronic airway disease. Its prevalence has been increased in a few past decades. The role of trace elements of zinc, magnesium and calcium have evaluated on the pathophysiology of asthma in the early decades. The purpose of present study was to assess status of zinc, magnesium and calcium in serum of patients with chronic bronchial asthma in Tehran.

Material and methods: Patients with chronic persistent asthma enrolled sequentially based on the GINA guideline. Zinc, magnesium and calcium in serum measured with the recommendation's manufacturer protocols.

Results: A total of 137 subjects participated in the present study. Of them, females were 58.4% and males 41.6%. The mean age was 33.77 ± 8.33 SD years. The frequency of zinc, magnesium and calcium deficiency detected 10.2%, 8%, 5.8%, respectively.

Conclusion: Hypozincemia hypomagnesemia and hypocalcemia found in selected patients with stable chronic persistent asthma. Noticeable of entire current trace elements deficiency observed in the female sex. However, significant differences of Ca deficiency between genders revealed effects of sex on the calcium homeostasis. Detection and improvement of trace elements, and electrolyte abnormalities should be beneficial in the outcome of asthma management.

Keywords: Asthma, Zinc, Magnesium, Calcium, Deficiency, Chronic, Adults.

Introduction

Bronchial asthma (BA) is a chronic inflammatory airway's disease. It characterized with bronchotracheal hyper-responsiveness and airway reversibility. BA is a major public health problem, and its incidence

has been increased in lots of countries in the recent decades. Heterogeneous environmental pathogens have influenced on the triggering episodes, management and outcome of asthma[1].

Zinc (Zn) is nutritionally an essential trace element. It has considerable functions on the airway

conducting system such as; anti-inflammatory effect and anti-oxidant agent[2]. However, Zn enables to influence on the host defense systems (cell-mediated response), lower respiratory tract infections, opportunistic infections and death [3]. Aside, Zn has the cytoprotective effect on the airway cells and effectual on the smooth muscle relaxation[4].

Magnesium (Mg) is the most abundant intracellular cation. Mg plays the role on the respiratory system. The topics of recent concept include smooth muscle relaxation, stabilization of mast cells; bronchodilator and anticholinergic effects[5], [6]. In addition, there are links between magnesium deficiency with increasing tracheobronchial hyperreactivity and decreasing lung function [7], [8].

The intracellular influx of calcium (Ca) causes bronchial smooth-muscle contraction[9]. There is an inverse relation between actions of Mg with Ca. Magnesium deficiency enhances the action of Ca on the airway smooth muscles and vice versa.

The purpose of present study was to assess status Zn, Mg and Ca in serum of patients with chronic bronchial asthma in Tehran.

Material and methods

The study was descriptive and cross-sectional. It conducted in pulmonary ward of the Logman Hakeem general teaching hospital of Shahid Beheshti University of Medical Sciences (SBMU), Tehran-Iran, 2008 years. The Logman hospital is placed in the south of Tehran (capital of Iran). An admission rate of patients in the hospital was up to 180,000, and visiting rate in the chest clinic apparently were 3,500 patients annually.

The target population consisted of adult's patients with chronic persistent asthma. Participations sequentially enrolled among patients coming into the chest clinic. Chronic persistent asthma and

stability established through duration of disease over than three years and no history of exacerbation or admission to the emergency department and or hospitalization in prior three weeks. A diagnosis criterion of asthma applied via instruction of GINA guideline[10]. It includes measuring airway limitation and its reversibility. Asthma diagnosed based on the standard method of the improvement of Forced Expiratory Volume in one second (FEV1) after administration of a bronchodilator up to 12% or 200 ml.

Exclusion criteria consisted of following evidence. Asthma disease was the only respiratory disease in the background. No active infection presented preceding two months of the study. There was no history of neoplasia, osteoporosis management, cardiovascular, acute pancreatitis, renal diseases and convulsive disorders. Aside, small bowel disorders associated with diarrhea, malabsorption syndrome, steatorrhea, and small intestinal bypass surgery did not detect in our focus population. Subjects did not use supplements containing Mg, Zn and Ca, loop and thiazide-type diuretics and alcohol consumption [5], [6].

One physician visited all the patients. Information on demographic data, history of asthma disease, and topics of exclusion criteria collected with a self-administrated questionnaire. Standard Chest x-ray, pulmonary function test (spirometry equipment of Sensor Medics 2002, the Care Cardiopulmonary Company), measurement of total immunoglobulin E (IgE) antibody's levels and complete blood count also obtained for all subjects.

Whole of blood samples collected after a 12-h overnight fasting state. Zn concentration performed with the colorimetric method with Randox kit (No: 2341 Randox laboratories' Ltd). Zn deficiency computed below 70 µg/dl. Cut-off set point of

hypomagnesemia was 1.7 mg/dl. Mg concentration in serum carried out with the colorimetric assay (Pars Azemon Co Ltd). Normal value of Ca in our laboratory was 8.5 - 11 mg/dl .Calorimetric method used for Ca measurement (Darman Kave Res Lab. Isfahan,Iran).

Data are presented as mean ± standard deviations and analyzed with SPSS program, version 16. Data for all variables were normally distributed. Statistically analyses performed by the independent-samples T test. The limit of statistical significance was set at P<0.05.

Results

A total of 137 subjects completed criteria of the study. Of them, males were 41.6% and females 58.4%. Mean age recorded 33.77 ± 8.33 SD years, ranged over 20-50 years, median: 33 years. Males to the females’ ratio were 57/80. Table 1 shows characteristics group and subgroups of target population.

The frequency of zinc deficiency met below cut –off point was 10.2 %(14). Its mean was 101.30± 24.63 SD µg/dl. Distribution of Zn deficiency occurred in the female sex 57% and in the 3rd decades.

The mean ± SD of Mg in serum detected 2.01 ± 0.29 mg/dl. Eleven patients (8%) had Mg deficiency. 55% of hypomagnesemia observed in the female at the 2rd decade 46%.

Hypocalcemia found in 5.8%(8) of target population.

Table-1 shows characteristics of zinc , magnesium and calcium in selected population of chronic bronchial asthma

	Chronic asthma	Male subset	Female subset	P value
Number	137	57	80	
Age	33.77 ± 8.33	32.21 ± 7.42	34.88 ± 8.80	0.06
Zinc	101.30 ± 24.63	103.83± 72.13	99.50 ± 22.68	0.3
Magnesium	1.99 ± 0.29	1.99 ± 0.29	2.02 ± 0.29	0.5
Calcium	9.43± 0.45	9.56 ± 0.46	9.33 ± 0.43	0.004

Its mean was 9.43 ± 0.45 mg/dl. 3th decade showed more distribution of Ca deficiency 50%, accompanied with profound female sex 75%.

Figure- 1 reveals distribution of Zn, Mg and Ca deficiencies in the sex. No significant differences in Zn and Mg levels were observed between men and women. In addition, Zn , Mg and Ca deficiencies observed meaningfully in the female sex. However, Ca deficiency was found statistically significant between male and female sex (P=0.004).

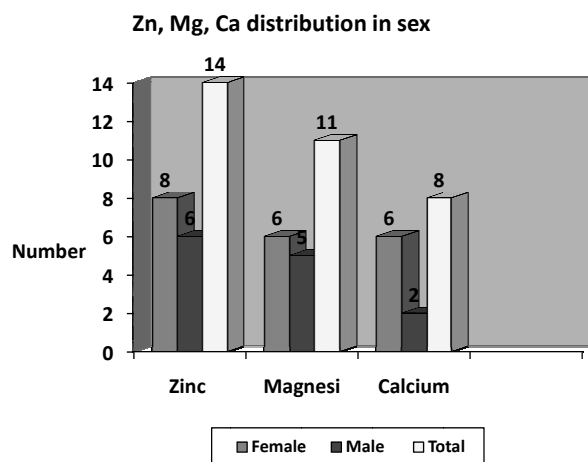


Figure- 1 discloses distribution Zinc , Magnesium and calcium deficiencies in the sex subgroups

Discussion

Meaningful hypozincemia, hypomagnesemia and hypocalcemia detected in the selected stable and chronic persistent asthmatic patients, respectively.

Searching of database indicated that link between

zinc deficiency and asthma diseases has been limited, and principally related to dieting and drug's issues. The first report of a human being Zn deficiency, which developed by zinc-deficient diet was published in Middle East and Iran since 1963[11]. Our knowledge indicated that altered Zn homeostasis related to constant dietary intake. The body has not the Zn store, and a regular dietetical ingestion is essential. The adult body contains apparently 2g Zn. The principal source of diets is enriched with Zn, including; meat, seafood, nut and cereal. In contrast, Frank human nutritional Zn deficiency is not easily developed in present conditions whereas low zinc diets are fed. In addition, Detection and diagnosis of Zn deficiency are not readily in serum and plasma [12]. Mild form or marginal Zn deficiency has not been specific symptoms and may not be diagnosed clinically. Feeding of inhibitory substances such as; phytate which find in most vegetables (corn, rice) can be help to decrease zinc absorption [13]. In addition, current report showed that consumption of diets with deficient in anti-oxidants and mineral cofactors increased incidence of asthma and allergic diseases [14]. Evaluation of diet's participations was impossible among target population. However, consumption of rice is an important portion of the daily regime of Iranian.

Zn has a protective role in the airways. Zn deficiency caused enhanced oxidative damage, increased superoxide and nitric oxide production and induced inflammation in the airways 4. The most common drugs currently used in asthma management are glucocorticoids, β 2-adrenergic agonists and theophylline. Glucocorticoids a novel in treatment of asthma has been reported to decrease serum Zn when used in large doses (e.g., in the attack state) [15]. Aside, the link between Zn deficiencies with bronchodilator's drugs has not been found during

the literature review. Using the glucocorticoid in the management of asthma seems to be the only causal factor of Zn deficiency in our study. However, now, the essential management of asthma has been based on the inhalation therapy, and systemic glucocorticoids less commonly used for the management of chronic bronchial asthma.

Bronchial asthma, as an chronic inflammatory disease may be effective in development of impact issue of zinc deficiency. It is another concept suggested in recent years. Medical based evidence of Zn status revealed that lowest Zn levels had been observed in other types of chronic inflammatory diseases. However, recent report was shown that increasing urinary excretion of Zn was detected in diabetes mellitus [16], [17]. In addition, rheumatoid arthritis disease, as a chronic inflammatory disease may be presented in low plasma Zn level while disease activity extended [18].

Considerable hypomagnesemia was observed in the selected study population of chronic asthma disease. Recent knowledge presented hypomagnesemia as a communal electrolyte disorder in the critically ill patients[19]. However, Current report indicated that hypomagnesemia was a common disorder among asthmatic patients (5 allamodi). Review of literatures showed that a few limited studies have been found in the chronic asthma. The role of Mg was established on the BA in the recent decades. Mg seems to be inducing inflammatory response[20], modulating smooth muscle contraction through its antagonism with calcium and promotion of nitric oxide synthesis[21]. In addition, it has the effect on the morbidity and management of asthma such as; decreasing hospitalization and improvement of lung function. Etiology of hypomagnesemia was not quite understood in chronic asthma. The causal factors of Mg deficiency were reported including

low dietary magnesium[22], using β 2-agonist by oral [23] or intravenous route (Iv)[24] and Iv-theophylline[25]. The overall suggested mechanism of hypomagnesemia in serum of patients with asthma consisted of excretion of Mg via urine or intracellular shift in susceptible patients [26]. It seems drugs, which take in asthma management had a significant role in the development of hypomagnesemia in chronic asthma. Our result can be an improvement with resultants in earlier studies. Regarding of the Mg and Zn pathophysiology on the asthma, It may be suggested that combine deficiency had potential effects on the morbidity and management of asthma.

Hypocalcemia observed significantly in our study. In recent years, hypocalcemia has not been reported in chronic asthma 5. Effect of Ca on the respiratory system was approved in the asthma disease. Rising of cellular Ca concentration leads to release of chemical mediators from mast cells and basophiles against antigenic stimulation [27]. Aside, the intracellular influx of Ca causes bronchial smooth-muscle contraction [5]. Negative relationship established between magnesium concentration and Ca action on the contraction property of smooth muscle [28]. Mg deficiency associated with calcium disturbance influence on bronchial smooth muscle contraction. The causes of hypocalcemia were predominantly related to taking drugs in the management of asthma. Hypocalcemia has also been reported after administration of β 2-agonists[29] and Iv-Aminophylline in normal subjects and in asthmatic patients as well [30], [31]. A significant difference of Ca deficiency was seen between male to female sex. It supported influence of sex on the calcium homeostasis.

In conclusion; the results of the present study showed a meaningful prevalence of zinc, magnesium and

calcium deficiency in chronic persistent asthma. Distribution frequency of Zn, Mg and Ca deficiency was predominant in female sex. Hypocalcemia has not been reported among chronic asthmatic patients as yet. In addition, there were significant differences of hypocalcemia in the gender represented effect of casual sex factors on the calcium homeostasis. Our finding perhaps related to topics of nutrition intake and using medications. Diagnosis and detection current bivalent cations should be useful to the management of asthma for a physician.

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