

Estimation of Serum Magnesium Levels in the Patients of Acute Cases of Bronchial Asthma

FOZIA SHAIKH¹, SYEDA NARGIS FATIMA², MUHAMMAD AMIR ALSABAH³, ZEESHAN UL HAQ⁴, MUBEENA LAGHARI⁵, ALI RAZA MEMON⁶

¹Senior Lecturer Biochemistry Department Liaquat University of Medical & Health Sciences, Jamshoro

²Assistant Professor Physiology Department Liaquat College of Medicine and Dentistry, Karachi

³Senior Registrar Pulmonology Department Bhawalpur Medical and Dental College, Bhawalpur

⁴Consultant Physician Bhitai Government Hospital, Hyderabad

⁵Associate Professor, Biochemistry Department Liaquat University of Medical & Health Sciences, Jamshoro

⁶Associate Professor Biochemistry Department Liaquat University of Medical & Health Sciences, Jamshoro

Corresponding author: Ali Raza Memon, Email: raza.memon@lumhs.edu.pk.

ABSTRACT

Background: The prevalence of Bronchial Asthma increasing day by day at Asian countries due to environmental & nutritional factors. Magnesium plays important role in the prevention of bronchial asthma because magnesium causes the relaxation of smooth muscles & dilatation of bronchioles. This study was aimed to estimate the serum magnesium level in the patients of newly diagnosed cases of acute asthma.

Methodology: This cross sectional study was conducted by the Department of Biochemistry with collaboration Pulmonology OPD LUMHS Hospital Hyderabad. Total 55 newly diagnosed cases of acute asthma between the age of 31 -60 years were selected with their own consent for this study. The patients were selected on the basis of GINA guidelines. Serum magnesium level was estimated by kit method by auto analyzer.

Results: total 55 newly diagnosed cases of acute asthma divided in to three groups according to age Gr:-I (31 -40 years) Gr:-II (41-50 years) Gr:-III (50-60 years). Serum mean serum magnesium levels in Gr:-I was 1.21 ± 0.12 mg/dl, Gr:-II 1.01 ± 0.09 mg/dl while in Gr:-III 0.97 ± 0.87 mg/dl. The mean serum magnesium level significantly decline in group -II & III.

Conclusion: Our study concluded that serum magnesium level has decline in the cases of acute attacks of bronchial asthma and also noted in this study that serum magnesium decline directly proportional with elder age.

Keywords: Acute Bronchial Asthma, Serum Magnesium, GINA guidelines, COPD

INTRODUCTION

Bronchial asthma is the inflammation of bronchial airways due to genetically or environmentally predisposition.¹ Acute bronchial asthma is present with shortness of breath, wheezing, cough, chest congestion with forced expiratory volume (FEV1) between 25 -30%.^{2,3} The prevalence of bronchial asthma increasing day by day is Asian population due to multiple factors like high usage of tobacco, agricultural and industrial pollution etc.^{4,5} Bronchial asthma also part of chronic obstructive pulmonary disease (COPD).⁶

Magnesium is the commonly involved in more than 300 metabolic reactions as cofactor.⁷ It is presented as intracellular as well extracellular cation but commonly it is considered as one of the major intracellular cation.⁸ It is form key complex with high energy compound ATP so act as cofactor in energy yielding metabolic reactions which mostly observed in enzymatic reactions of replications, normal cellular functions and energy metabolism.^{7,8}

Total more than 1000 mmol of magnesium present in human body more than half of the magnesium present in bones very rare quantity like 1% present in extracellular compartment while remaining present as intracellular component.^{9,10} Near on third of magnesium present in bound form with albumin.¹¹ The commonly magnesium causes the relaxation of smooth muscles. In respiratory system physiologically it provides relaxation of smooth muscles of bronchial airways, maintenance of mast cells and dilatation of bronchioles.^{12,13}

Acute attack of asthma can be due to deficiency of magnesium because low level of magnesium can cause the inhibition of proper relaxation phase of smooth muscle, increase vascular tone which leads to muscular contraction.^{14,15} Low levels of magnesium also inhibit the secretion of acetylcholine from cholinergic nerves;¹⁶ these mechanisms participate in development of bronchial asthma also.

The aim & objective of this study to evaluate the serum magnesium level in the diagnosed cases of acute attack of bronchial asthma.

METHODOLOGY

This cross sectional study was carried out at LUMHS with collaboration of Department of Biochemistry LUMHS from July

2021 to December 2021. Total 55 patients of acute attack of asthma were selected from Pulmonology OPD LUMHS Hospital Hyderabad. The patients were selected on GINA¹⁷ guidelines means severe attack of asthma with severe cough, shortness of breath, wheezing, pulse rate more than 100 beats /min while respiratory rate more than 30/min with FEV1 between 25 -30%. The cases were divided in to three groups according to their age; group -I included patients having age between 31-40 years group-II patients having age 41-50 years, group -III having age between 51-60 years. The newly diagnosed cases of acute bronchial asthma with both genders male as well females having age between 31- 60 years were included in this study while the patients of chronic renal diseases, cardiac diseases, diabetes mellitus, alcoholics, chain smokers, patients on diuretic therapy, malnutrition or under nutrition cases will be excluded from this study.

After taken personal consent and bio data, clinical examination and spirometry examination was done by pulmonologist at pulmonology OPD LUMHS hospital Hyderabad, those cases which were labeled as new cases of acute bronchial asthma included in this study with their voluntarily consent. 2 ml of serum was drawn from cuboidal vein under aseptic measurement for the estimation of serum magnesium by kit method on auto analyzer machine. The normal serum magnesium value is 1.3 - 1.8mg/dl. The data was statistically analyzed by SPSS version 22 by applying chi square and student t test.

RESULTS

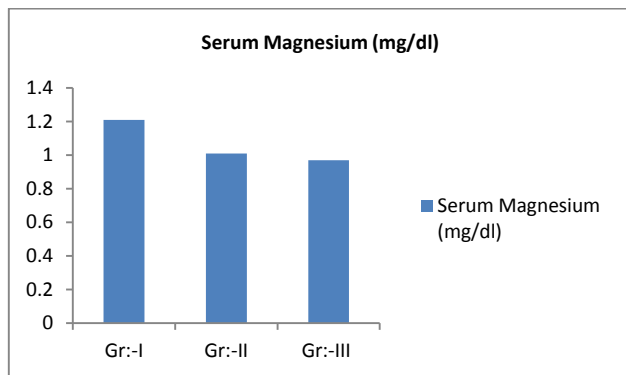
Total 55 patients with new onset of acute attack of asthma were selected; with clinically diagnosed by physician on their history, clinical signs and clinical examination. There were 39 males and 16 females and they were divided in to three groups on the basis of age. There was three groups according to age distribution which mentioned in table no: 01. Serum magnesium was statistically analyzed by chi square and fisher test in different groups.

Table 1: Gender Distribution in All Groups Under Study

Age Groups	Males	Females
I- 30-40 years	10	4
II- 41-50 years	13	9
III- 51-60 years	16	3

Table 2: Mean serum Magnesium Levels in All Groups of Acute Asthma

Groups	Mean Serum Magnesium (mg/dl)
Gr:-I	1.21 ± 0.12
Gr:-II	1.01 ± 0.09*
Gr:-III	0.97 ± 0.87*



The above findings suggested that serum magnesium statistically significantly decline in group –II ($p < 0.05$) and more declined in the patients of group –III ($P < 0.001$) means as age increases the serum magnesium levels declined more.

This study suggested that serum magnesium levels become declined in more than 60-70% patients of acute attacks of asthma and also serum magnesium levels more prone to decline in elder age as compared to younger age.

DISCUSSION

The magnesium is major intracellular cation and macro element¹⁸ performs several functions neuromuscular, cardiovascular and metabolic functions in human body.¹⁹The contraction of skeletal and smooth muscles also under influenced of magnesium. Magnesium also plays role in neuro synaptic junctions because it inhibits the secretion of acetylcholine.^{15,16}Depletion of magnesium in asthmatic patients is multifactorial may be genetic predisposition, may be urinary loss of magnesium due to drugs may be deficient due to dietary less intake. Low serum magnesium also associated with poor lung function.²⁰

The current study shows that serum magnesium levels reducing in the patients of acute bronchial asthma, our study also shows that mean serum magnesium level more decline in elder age group (Gr:-III) ($P < 0.001$) as compared to younger age group. The status of magnesium in different types of bronchial asthma debatable issue from many decade.

Our study supported by Ye M (2021)²¹ observed that serum magnesium depletion with poor lung functions in patients of asthma while serum magnesium not depleted in the patients with disturbance of Forced expiratory volume (FEV).

On other hand our study not supported by Barbagallo B et al (2021)²⁰ they concluded that serum magnesium level depletion not significantly observed in acute attacks of asthma but depletion of magnesium observed in chronic inflammatory diseases like COPD, diabetes mellitus etc.

The study of Maier JA et al (2021)²² support our study they concluded that serum magnesium level depleted during acute inflammation phase also like acute attacks of asthma. Same Abuabat F et al (2019)²³ studied that magnesium therapy has beneficial role in the prevention and treatment of bronchial asthma even shown positive results in children also.

Our study has some limitations like sample size too short, sample collection from only one medical hospital, selected only newly diagnosed cases of acute asthma. In future there will be need to evaluate serum magnesium levels in COPD in our population and also estimation of magnesium in chronic cases of asthma along with different drugs regimens.

CONCLUSION

Our study concluded that serum magnesium level has decline in the cases of acute attacks of bronchial asthma and also noted in this study that serum magnesium decline directly proportional with elder age.

REFERENCES

- Krynytska I, Marushchak M, Mykolenko A, Smachylo I, Sopel O, Kucher S. Bronchial Asthma: Genetic Factors Contributing to its Pathogenesis. *Open Access Macedonian Journal of Medical Sciences*. 2021 Feb 5;9(F):590-4.
- Nowshheen S, Darveaux JI. Real-world efficacy and safety of dupilumab use in the treatment of asthma. *Annals of Allergy, Asthma & Immunology*. 2021 Jul 1;127(1):147-9.
- Yu X, Wei J, Li Y, Zhang L, Che H, Liu L. Longitudinal assessment of pulmonary function and bronchodilator response in pediatric patients with post-infectious bronchiolitis obliterans. *Frontiers in Pediatrics*. 2021 May 19;9:460.
- Hsu HT, Wu CD, Chung MC, Shen TC, Lai TJ, Chen CY, Wang RY, Chung CJ. The effects of traffic-related air pollutants on chronic obstructive pulmonary disease in the community-based general population. *Respiratory research*. 2021 Dec;22(1):1-2.
- Desalu OO, Adeoti AO, Ojuawo OB, Aladesanmi AO, Oguntayo MS, Afolayan OJ, Bojuwoye MO, Fawibe AE. Urban–Rural Differences in the Epidemiology of Asthma and Allergies in Nigeria: A Population-Based Study. *Journal of Asthma and Allergy*. 2021;14:1389.
- Tanabe N, Sato S, Oguma T, Shima H, Kubo T, Kozawa S, Koizumi K, Sato A, Togashi K, Matsumoto H, Hirai T. Influence of Asthma Onset on Airway Dimensions on Ultra–high-resolution Computed Tomography in Chronic Obstructive Pulmonary Disease. *Journal of thoracic imaging*. 2021 Jul 7;36(4):224-30.
- Xie K, Cakmak I, Wang S, Zhang F, Guo S. Synergistic and antagonistic interactions between potassium and magnesium in higher plants. *The Crop Journal*. 2021 Apr 1;9(2):249-56.
- Nguyen TM, Tran VG, Nguyen TC, Nguyen BN. Role of Intracellular Divalent Cations on the Adenylate Cyclase Activation by Human LH in Mltc-1 Leydig Cells. *Journal of Applied Biotechnology Reports*. 2021 Dec 1;8(4):370-4.
- Kebr NE, Zahzeh T. Magnesium Deficiency Associated with Stress, Systemic Inflammation, and Insulin Resistance in Diabetes Mellitus: a review. *Egyptian Academic Journal of Biological Sciences. C, Physiology and Molecular Biology*. 2022 Jan 14;14(1):31-46.
- Vanoni FO, Milani GP, Agostoni C, Treglia G, Faré PB, Camozzi P, Lava SA, Bianchetti MG, Janett S. Magnesium metabolism in chronic alcohol-use disorder: Meta-analysis and systematic review. *Nutrients*. 2021 Jun;13(6):1959.
- Mardina Z, Venezuela J, Dargusch MS, Shi Z, Atrens A. The influence of the protein bovine serum albumin (BSA) on the corrosion of Mg, Zn, and Fe in Zahrina's simulated interstitial fluid. *Corrosion Science*. 2022 May 1;199:110160.
- Jahangir A, Zia Z, Niazi MR, Saha S, Jahangir A, Sharif MA, Chalhoub MN. Efficacy of magnesium sulfate in the chronic obstructive pulmonary disease population: a systematic review and meta-analysis. *Advances in Respiratory Medicine*. 2022 Jan 27.
- Hassan EE, Abusaad F, Mohammed B. Buteyko Breathing Technique: The Golden Way for Controlling Asthma among Children. *Mansoura Nursing Journal*. 2021 Jul 1;8(2):1-2.
- Al Alawi AM, Majoni SW, Falhammar H. Magnesium and human health: perspectives and research directions. *International journal of endocrinology*. 2018 Apr 16:2018.
- ur Rashid MH, Chowdhury MR, Faraji MA, Rahman S. Assessment of serum magnesium level in patients with bronchial asthma. *Journal of National Institute of Neurosciences Bangladesh*. 2019 Jul 12;5(1):38-41.
- Osuntokun, O.S., Abdulwahab, U.F., Akanji, N.O., Adedokun, K.I., Adekomi, A.D. and Olayiwola, G., 2021. Anticonvulsant and neuroprotective effects of carbamazepine-levetiracetam adjunctive treatment in convulsive status epilepticus rat model: Inhibition of cholinergic transmission. *Neuroscience Letters*, 762, p.136167.
- Baldacci S, Simoni M, Maio S, Angino A, Martini F, Sarno G, Cerrai S, Silvi P, Pala AP, Bresciani M, Paggiaro P. Prescriptive adherence to GINA guidelines and asthma control: an Italian cross sectional study in general practice. *Respiratory medicine*. 2019 Jan 1;146:10-7.
- Moisa C, Cadar OA, Barabas R, Vicas LG, Hoaghia MA, Levei EA, Jurca CL, Berce C. Influence of magnesium compounds on sodium, potassium and calcium levels in different mice organs. *Farmacologia*. 2019 Mar 1;67:274-82.

19. Pickering G, Mazur A, Trousselard M, Bienkowski P, Yaltsewa N, Amessou M, Noah L, Pouteau E. Magnesium status and stress: The vicious circle concept revisited. *Nutrients*. 2020 Dec;12(12):3672.
20. Barbagallo M, Veronese N, Dominguez LJ. Magnesium in aging, health and diseases. *Nutrients*. 2021 Feb;13(2):463.
21. Ye M, Li Q, Xiao L, Zheng Z. Serum magnesium and fractional exhaled nitric oxide in relation to the severity in asthma-chronic obstructive pulmonary disease overlap. *Biological Trace Element Research*. 2021
22. Maier JA, Castiglioni S, Locatelli L, Zocchi M, Mazur A. Magnesium and inflammation: Advances and perspectives. In *Seminars in Cell & Developmental Biology* 2021 Jul 1 (Vol. 115, pp. 37-44). Academic Press.
23. Abuabat F, AlAlwan A, Masuadi E, Murad MH, Jahdali HA, Ferwana MS. The role of oral magnesium supplements for the management of stable bronchial asthma: a systematic review and meta-analysis. *NPJ primary care respiratory medicine*. 2019 Feb 18;29(1):1-8. May;199(5):1771-7.