ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 7, Issue – 5, October - 2024, Page No. : 113 – 117

A Study of Serum Magnesium Levels in People Living With HIV on Anti Retroviral Therapy

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How to citation this article: Dr Bharath D S, Dr Tirthankar Mukherjee , Dr Rakshith S C, Dr Ramachandra Prabhu H D, "A Study of Serum Magnesium Levels in People Living with HIV on Anti Retroviral Therapy", IJMACR- October - 2024, Volume – 7, Issue - 5, P. No. 113 – 117.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: The rise of life expectancy as a result of the antiretroviral therapy (ART) in subjects with human immunodeficiency virus (HIV) has increased the prevalence of chronic medical conditions, such as kidney disease. Kidney disease prevalence in subjects with HIV infection is reported between 3.5% and 48.5%. Second-generation INSTIs are currently the class of choice in ART regimens due to their high potency, good tolerability, low toxicity and high genetic barrier to resistance. INSTIs are believed to work by chelating magnesium ion to prevent HIV from integrating into host DNA. Magnesium is involved in the regulation of mitochondrial function, inflammatory process and immune defense, allergy, growth and stress and in the control of neuronal activity, cardiac excitability, neuromuscular transmission, vasomotor tone and blood pressure. Magnesium is an intracellular component of bone cells. A number of studies have reported changes in bone density accompanied by changes in serum levels of phosphate, alkaline phosphate and serum magnesium. Thus, this study is being conducted to estimate the Serum Magnesium levels in people living with HIV on ART.

Materials: This case-control study was performed among 25 People living with HIV on ART and 25 age

and sex matched controls attending the department of general medicine, Kempegowda institute of medical sciences during an 18-month period. Serum Magnesium levels were evaluated among all the cases and controls. The data was collected and compiled in MS Excel. Descriptive statistics has been used to present the data. To analyse the data SPSS (Version 26.0) was used. Significance level was fixed as 5% ($\alpha = 0.05$. Qualitative variables are expressed as frequency and percentages and Quantitative variables are expressed as Mean and Standard Deviation. To compare the association between numerical and categorical variables, student t test was used and to compare the association between categorical variables chi square test was used.

Observation: The mean age of the cases and controls were found to be 49.32$\pm$7.587 and 49.28$\pm$7.531 respectively. 84% of the study participants in each group were males. 4% of the study participants in each group had type 2 diabetes mellitus. The mean duration of ART among the cases was found to be 13.48$\pm$4.736 months. The mean serum magnesium among the cases and controls were found to be 1.7188$\pm$0.238 and 2.0300$\pm$0.232 respectively. The mean serum magnesium levels were found to be lower among the cases than the controls with statistical significance ($P<0.05$).

Conclusion: Serum magnesium levels have to be routinely checked among all HIV patients to prevent bone complications. Serum bone profiling a potentially non-invasive, inexpensive method that can be used routinely to detect changes in bone metabolism in the HIV infected patients.

Keywords: HIV, ART, INSTI, Magnesium

Introduction

HIV infects cluster of differentiation 4 (CD4) T-lymphocytes, monocytes, and macrophages. As a result of this infection, the number and function of CD4 cells are reduced and both cell-mediated and humoral immunity are affected [1].

Magnesium is an important electrolyte. Magnesium is involved in most metabolic processes and contributes to DNA and protein synthesis. Magnesium is involved in the regulation of mitochondrial function, inflammatory process and immune defense, allergy, growth and stress and in the control of neuronal activity, cardiac excitability, neuromuscular transmission, vasomotor tone and blood pressure. Normal serum magnesium levels are between 1.46 and 2.68 mg/dL. Hypomagnesaemia is an electrolyte disturbance caused when there is a low level of serum magnesium (less than 1.46 mg/dL) in the blood [2].

The high disease burden of HIV has necessitated a rapid increase in the use of Antiretroviral therapy (ART). ART has reduced both the morbidity and mortality of HIV-infected people due to AIDS [3]. ART restores immune function and reduces HIV-related adverse outcomes. Despite documented benefits of antiretroviral drugs, its use is not without side effects. Second-generation INSTIs are currently the class of choice in ART regimens due to their high potency, good tolerability, low toxicity and high genetic barrier to resistance. INSTIs are believed to work by chelating magnesium ion to prevent HIV from integrating into host DNA [4].

Thus, estimation of Serum Magnesium levels in people living with HIV on ART is essential to treat hypomagnesaemia and prevent clinical manifestation of Hypomagnesaemia.

Aims and Objectives of the Study

To study serum magnesium levels in PLHIV on antiretroviral therapy.

Methodology

Study Design: Cross-sectional study

Study Duration: 18 months

Study Area: KIMS hospital, Bangalore.

Study Participants: Patients with HIV attending KIMS hospital, Bangalore.

Inclusion Criteria

- Patient aged > 18years
- PLHIV on first line ART

Exclusion Criteria

- Patient under age 18 years.
- Patients on drugs interacting with serum magnesium levels like lithium, aminoglycoside antibiotics like amikacin, kanamycin. Streptomycin, antineoplastics cisplatin carbaplatin.
- Patients with renal disease.
- Patients with endocrine disorders like Addison's disease and thyroid disease.
- Patients with liver disorders

Sample Size

The sample size for the present study has been estimated using the software GPower v. 3.1.9.4 (Franz Faul, Universität Kiel, Germany) Considering the effect size to be measured (d) at 80% for Two-tailed Hypotheses based on the study done by Mudzinge D et al [5], power of the study at 80% and the alpha error at 5%, the total sample size needed is 50. Thus, each group will comprise of 25 samples.

Method of Collection of Data:

The study was conducted in department of medicine, KIMS hospital, Bangalore. Clearance from the institutional ethical committee was taken before starting the study. Written consent was obtained from all the study participants samples. Study participants were included in the study by Purposive Sampling technique. A pretested, semi-structured questionnaire was used to collect the information on socio-demographic variables and history of HIV by interview method. Serum magnesium levels were evaluated and compared with controls

Statistical Analysis

The data was collected and compiled in MS Excel. Descriptive statistics has been used to present the data. To analyse the data SPSS (Version 26.0) was used. Significance level was fixed as 5% ($\alpha = 0.05$). Qualitative variables are expressed as frequency and percentages and Quantitative variables are expressed as Mean and Standard Deviation. To compare the proportion between variables, chi-square test was used. To compare the mean values between variables, student t test was used.

Results

The mean age of the cases and controls were found to be 49.32+7.587 and 49.28+7.531 respectively. 84% of the study participants in each group were males. 4% of the study participants in each group had type 2 diabetes mellitus. The mean duration of ART among the cases was found to be 13.48+4.736 months. The mean serum magnesium among the cases and controls were found to be 1.7188+0.238 and 2.0300+0.232 respectively. The mean serum magnesium levels were found to be lower among the cases than the controls with statistical significance ($P<0.05$).

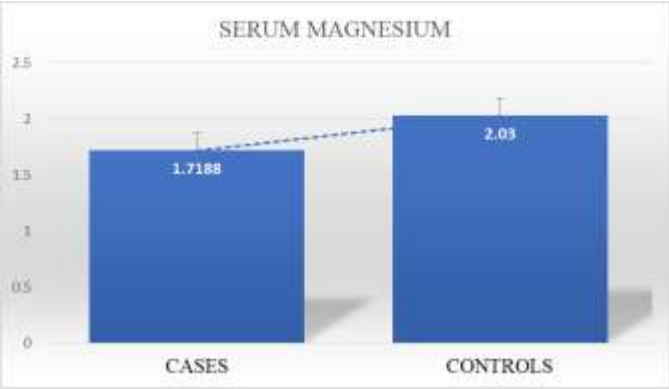
Table 1: Patient Characteristics

Patient Characteristics			Group		P Value
			Cases	Controls	
Age	Mean ± Sd		49.32±7.58	49.28±7.53	0.985
Gender	Male	Count	21	21	1.000
		%	84.0%	84.0%	
	Female	Count	4	4	
		%	16.0%	16.0%	
Comorbidities	Nil	Count	24	2	1.000
		%	96.0%	96.0%	
	Type 2 Dm	Count	1	1	
		%	4.0%	4.0%	
Duration Of Art	Mean ± Sd		13.48±4.736	-	-

Table 2: Serum Magnesium

Group	Serum Magnesium		P Value
	Mean	Std. Deviation	
Cases	1.7188	0.23828	0.001
Controls	2.0300	0.23276	

Graph 1:



Discussion

Afridi HI, Kazi TG, Talpur FN, et al. included sixty-two males with HIV (HIV-1) or AIDS and 120 healthy males of the same age group (31-45 years) [6], the results of which indicated significantly lower levels of serum magnesium of patients in comparison to the healthy controls ($p < 0.01$) which is in consonance with our study.

Obum-Nnadi CN, Nathaniel O, Mbata TI, et al. study showed that there was a significant association of the level of magnesium in the plasma in both genders with HIV/AIDS infection [7] which was observed in our study.

Pantaleo G, Graziosi C, Fauci AS et al. study [8] reported that serum magnesium in HIV/AIDS patients was low, and the present study confirmed it.

Conclusion

The results provide additional evidence that lower magnesium concentrations occur in HIV-infected subjects compared to healthy controls. Close monitoring of magnesium is necessary especially when the patients receive drugs that can complicate magnesium deficiency. Further studies are needed to investigate the possible association between magnesium and CD4 cells.

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