

Find Out the Association of Serum Mg Levels with Diabetes and Its Comparison with Non-Diabetics

Dr. Bushra Khanam, Dr. Abhyudaya Verma^{2*}, Dr. Nikunj Bavishi³, Dr. Harsha Dangri⁴

¹Assoc. Prof, Dept. of Gen. Medicine, Index medical college, Indore, Madhya Pradesh, India

²Assoc. Prof, Dept. of Gen. Medicine, Index medical college, Indore, Madhya Pradesh, India

³Junior Resident, Dept. of Gen. Medicine, Index medical college, Indore, Madhya Pradesh, India

⁴Junior Resident, Dept. of Gen. Medicine, Index medical college, Indore, Madhya Pradesh, India

Original Research Article

*Corresponding author

Dr. Abhyudaya Verma

Article History

Received: 01.05.2018

Accepted: 08.05.2018

Published: 30.05.2018

DOI:

10.36347/sjams.2018.v06i05.024



Abstract: The present study was conducted in 100 control and 100 cases who were admitted under Medicine Department /Medicine OPD or Superspeciality Dept. of Endocrinology & Neurology in Index Medical College Hospital and Research Centre, during interval of 1 year from March 2016 to August 2017. In our study, 100 cases of DM were taken and 100 controls were included who had stroke. There were 10(10%) patients in the age group of 40-50 years, 26(26%) in the age group of 51-60 years, 34(34%) in the age group of 61 to 70 years, 24(24%) in the age group of 71 to 80 years and 06(6%) in the age group of >80 years in each group. There were 06(6%) patients in the age group of 40-50 years, 30(30%) in the age group of 51-60 years, 34(34%) in the age group of 61 to 70 years, 26(26%) in the age group of 71 to 80 years and 04(04%) in the age group of >80 years in each group to match the age approximation. There were 52(52%) males and 48(48%) females in each groups (diabetic & non-diabetic) studied both among case and controls. There was a male preponderance in comparison to the females. Out of 100 cases, 60(60%) had ischemic stroke, 30(30%) had hemorrhagic stroke and 10 (10%) had TIA in each group. Serum magnesium level was estimated in above all cases (200 patients). Mean serum magnesium level were lower in stroke cases compare to the control group. Mean magnesium level of control group (100) were compared with our Ischemic and hemorrhagic stroke patients and p value showed significance but TI patients had no significant p value when compared with control. The serum magnesium level between diabetics and non-diabetics among case were observed, which showed low serum magnesium in diabetes patients. The serum magnesium level between diabetics & non-diabetics were also compared. Low magnesium level among non-diabetics who has stroke but was more so in diabetics. So, irrespective of diabetes status, hypomagnesaemic patients are more prone to develop stroke/neurological complication. The significance of this study is that low serum magnesium level is associated with acute neurological complication like ischemic or hemorrhagic stroke.

Keywords: Diabetes, Serum & Magnesium.

INTRODUCTION

Diabetes, dislipidemia & renal disorder disturbed acid base balance & metabolism of calcium & magnesium also. A meta-analysis of prospective cohort studies by researchers at Stockholm's Karolinska Institute, reported that for every 100 milligram increase in magnesium intake, the risk of developing type 2 diabetes decreased by 15 percent [1].

Published in Journal of Internal Medicine Susanna Larsson and Alicia Wolk concluded that while is too early to recommend magnesium supplements for type 2 diabetes prevention, increased

consumption of magnesium rich diet seems to improve & help prevention of Neurological Complication[1]. It was reported by researchers at Stocklom's Karolinska Institute that for every 100 milligram increase in magnesium intake, the risk of developing type 2 diabetes decreased by 15 percent[2].

Diabetes mellitus is usually associated with hypomagnesemia [ionized form] and therefore may be accompanied by atherogenic alteration in the blood lipid composition and increased morbidity from cardiovascular diseases [4]. It has been seen that serum magnesium concentration is lower in diabetes patients

than in non-diabetic patients, with an inverse relation between the HbA1C concentration and magnesium [5].

This study was conducted a study on 100 type 2 diabetes mellitus patients in Index Medical College, Indore over the period of one year between 1st January 2011 to 31st December 2011. Detailed history, general physical examination, systemic examination, and various investigations like FBS, PPBS, HbA1C, Blood urea, serum creatinine and urine examination were carried out. Serum magnesium was estimated by Calmagite dye method. ECG findings were recorded. Retinopathy was assessed by direct ophthalmoscopy. Hypomagnesemia was found in 65 patients. Their observations revealed significant correlations between hypo magnesium and diabetic retinopathy.

Arpaci *et al.* [9] conducted a study to explore relationships between the serum Mg level and diabetes complications. In this retrospective study, they evaluated 673 diabetic patients & had shown similar results of which 57.8% were males and 42.2% females. Mean patient age was 55.6 years and the mean duration of diabetes 81 ± 86.9 months. Their results showed that the mean level of HbA1c was $9.0 \pm 2.4\%$. The mean Mg level was 1.97 ± 0.25 (1.13–3.0) mg/dl. The patients were divided into two groups in terms of their serum Mg levels; low-level

MATERIALS & METHODS

The comparison of mean serum magnesium was found to be statistically significant ($P < 0.05$), showing that the serum magnesium level is varying in relation to the type of stroke. To find out the pair wise comparison, Post hoc Tukey test was applied:

In our study we compared different types of stroke & found that Mg levels are low in ischemic stroke & hemorrhagic stroke as compare to TIA. hemorrhagic stroke & thrombotic stroke has no significant mean serum Mg levels variations & hence pair in the study. Morbidity & Mortality due to cerebral vascular accident as compare to non-diabetics including the imaging studies diabetics suffered much more.

Disability & mortality which may be contributed to diabetic ketoacidosis, diabetic, adding to neurological complications & CVA. Low serum Mg levels are associated with neurological complication such as ischemic & hemorrhagic stroke if supplemented can have beneficial effect on diabetes & if hypertension is comorbidity with DM as Mg also acts anti-hypertensive agent & usually used in preeclampsia & eclampsia (hypertension associated

with pregnancy) athrechlorosis, dislepdimia also associated with diabeted as well as hypertension in Mg supplement is used the Mortality & Morbidity due to stroke either due to diabetes or hypertension or both can be reduced.

In our study serum Mg levels were low in diabetic patients as compare to non-diabetic if supplemented as dietary or therapeutic can have better outcome in patient who develop stoke. (≤ 1.8 $\mu\text{g/dl}$) and normal (1.9–2.6 $\mu\text{g/dl}$). Their results showed that microalbuminuria was more common in hypomagnesemic patients. Their results showed a weak negative correlation between serum Mg and HbA1c levels and also between serum Mg level and overt proteinuria. So they concluded that mg depletion is a common problem in patients with diabetes mellitus. It affects both glycaemic regulation and emergency of complications. Serum Mg level affected both glycaemic regulation and the extent of emergency diabetic complications.

Yang *et al.* [10] conducted a study and they analyzed postpartum serum magnesium levels and development of prediabetes and T2DM in women with prior GDM according to American Diabetes Association (ADA) criteria using the Korean National Diabetes Program (KNDP) GDM cohort. They did follow-up of 15.6 ± 2.0 months. They divided 116 women into three groups according to glucose tolerance status. In their study, eight patients (6.9%) were diagnosed with T2DM, 59 patients (50.9%) with prediabetes, and 49 patients (42.2%) with normal glucose tolerance (NGT) after follow-up. The T2DM group had the lowest serum magnesium level (0.65 [0.63-0.68] mM/L) in the postpartum period. They also found that postpartum serum magnesium level was also a possible predictor for T2DM development. So, they concluded that serum magnesium level in the postpartum period may be a possible predictor for T2DM development in women with a history of GDM.

RESULTLS & OBSERVATIONS

In the case group, the mean serum magnesium in the diabetic patients was $1.23 + 0.28$, while in the non-diabetic patients it was $1.67 + 0.49$. The difference was found to be statistically significant ($P < 0.05$), showing a higher mean serum magnesium level in non-diabetics in comparison to the diabetics.

In the control group, all the patients were non-diabetics; their mean serum magnesium level was 2.40 ± 0.37 . The mean serum magnesium in the ischemic stroke patients was $1.45 + 0.41$, while in the control group it was $2.40 + 0.37$. The difference was found to be statistically significant ($P < 0.05$), showing a higher serum magnesium level in the control group.

Table-1: Comparison of serum magnesium level between hemorrhagic stroke, serum magnesium level between TIA and the control group

| S. No. | Serum Mg level Diabetic Status | Mean ±SD | F Value | P Value | Serum Mg level Diabetic Status | Mean ±SD | F Value | P Value |
|--------|--------------------------------|------------|------------------|---------|--------------------------------|------------|-----------------|--------------|
| 1. | Hemorrhagic | 1.23 ±0.32 | -11.20, df=63 | 0.000* | TIA | 2.15 ±0.32 | -1.49, df=53 | -1.43, NS |
| 2. | Control Group | 2.40 ±0.37 | | | Control Group | 2.40 ±0.37 | | |

DISCUSSION

Cerebrovascular accident is most common cause of mortality and morbidity in India after age of 60 years ± 5.9 yrs. Low serum magnesium level is associated with increased prevalence of acute neurological complication like stroke.

In our study, we collected 100 control and 100 cases of cerebrovascular accident from the period of March 2016 to August 2017 which included 60 (60%) cases of Ischemic stroke, 30(30%) cases of Hemorrhagic stroke and 15(10%) cases of TIA.

Our study included measurement of serum magnesium level and its association with cerebrovascular accidents and also with diabetes. The present study evaluated the role of serum magnesium level in Stroke and TIA. Amighi *et al.* [6], studied low serum magnesium level and predicts neurological events in patient of advanced atherosclerosis and has shown increased predilection to stroke.

According to study done by Eminekoksaldi *et al.* trace elements like magnesium in serum and CSF composition showed significant low value in patient with stroke. In our study, the mean serum magnesium in the Ischemic stroke group was 1.45 + 0.41, and in the hemorrhagic stroke group was 1.24 + 0.32 and in the control group it was 2.40 + 0.37. In our study also, serum magnesium level is found low in stroke patient (both hemorrhagic and Ischemic stroke) compared to control group. And the difference was statistically significant. Difference of magnesium level between the TIA and control group were not significant statistically.

Odom *et al.* studied role of magnesium sulfate level in case of cerebral vasospasm in patient presented to emergency with acute stroke whose serum magnesium level is low. In our study also, serum magnesium level is found low in stroke patient (both Hemorrhagic and Ischemic stroke) compared to control group.

One more study done in India by Kaur *et al.* [7] showed serum magnesium levels significantly decreased in ischemic stroke, though hemorrhagic stroke patient as well as TIA also had magnesium deficiency. In our study also, serum magnesium level is found low in stroke patient (both hemorrhagic and ischemic stroke) compared to control group. IA patient

also had low serum magnesium level compared to control group in our study but it was not statistically significant.

Cojocar *et al.* [3], conducted a study on changes of serum magnesium in patients with acute Ischemic stroke. Their results confirmed that there is a relationship between a low Mg concentration in serum at 48 hours after onset of ischemic stroke and the intensity of the neurological deficit. A decrease in the serum Mg concentration indicates the severity of the injury. A magnesium substitution therapy may be useful. In our study also the mean serum magnesium level in the Ischemic stroke group was 1.45 + 0.41 and in the hemorrhagic stroke group was 1.24 + 0.32 and in the control group it was 2.40 + 0.37. In our study also, serum magnesium level is found lower in stroke patient (both hemorrhagic and ischemic stroke) compare to TIA patients and compare to control group.

CONCLUSION

The present study was conducted in 100 control and 100 cases who were admitted under medicine department or Medicine OPD or Superspeciality Dept. during interval of 1 year from March 2016 to August 2017. Out of 100 cases, 60 were Ischemic, 30 were hemorrhagic and 10 were TIA. In Diabetic group/non-diabetic group.

In our study, there was significant low serum magnesium level noted in the patient who presented with stroke. Our study showed low magnesium value in stroke patients when compared to control.

Hence cerebrovascular accident is more seen in patient with low serum magnesium level. So, we can conclude that hypomagnesemia patients are prone to stroke and correction of magnesium is advisable especially in patients who have one or more risk factors to develop stroke.

In our study, the serum magnesium level is lower in diabetes patients compare to non-diabetes patients in case group. Hypomagnesaemia patients are prone to develop diabetes. Deficiency of magnesium results in atherogenic alteration in blood lipid composition. Diabetes mellitus associated with magnesium deficiency and therefore diabetes is prone for atherosclerosis.

The significant conclusion of this study is that low serum magnesium level is associated with acute neurological complication like ischemic or hemorrhagic stroke.

SUMMARY

- In our study, 100 cases were taken and 100 controls were included.
- Serum magnesium level were estimated in all 100 control & diabetic patients cases. Mean serum magnesium level were lower in stroke cases compare to the control group.
- Mean magnesium level of control group (100) was compared with our Ischemic and hemorrhagic stroke patients and p value showed significance.
- Mean magnesium level of control group (100) was also compared with our TIA patients and p value showed not significant.
- The serum magnesium level between diabetics and non-diabetics among case were observed, which showed low serum magnesium in diabetes patients is lower than the control.
- The serum magnesium level between case group of non-diabetics and control group of non-diabetics were observed, which showed low magnesium level among case group of non-diabetics. So, irrespective of diabetes status/duration/age, hypomagnesaemic patients are more prone to develop stroke.
- The significance of this study is that low serum magnesium level is associated with acute neurological complication like ischemic or hemorrhagic stroke.

REFERENCES

1. Ohira T, Peacock JM, Iso H, Chambless LE, Rosamond WD, Folsom AR. Serum and dietary magnesium and risk of ischemic stroke: the Atherosclerosis Risk in Communities Study. *American journal of epidemiology*. 2009 Apr 16;169(12):1437-44.
2. Cojocaru IM, Cojocaru M, Burcin C, Atanasiu NA. Serum magnesium in patients with acute ischemic stroke. *Romanian journal of internal medicine= Revue roumaine de medecine interne*. 2007;45(3):269-73.
3. Cojocaru IM, Cojocaru M, Burcin C, Atanasiu NA. Serum magnesium in patients with acute ischemic stroke. *Romanian journal of internal medicine= Revue roumaine de medecine interne*. 2007;45(3):269-73.
4. Kim DJ, Xun P, Liu K, Loria C, Yokota K, Jacobs DR, He K. Magnesium intake in relation to systemic inflammation, insulin resistance, and the incidence of diabetes. *Diabetes care*. 2010 Dec 1;33(12):2604-10.
5. Pickup JC, Chusney GD, Crook MA, Viberti GC. Hypomagnesaemia in IDDM patients with

- microalbuminuria and clinical proteinuria. *Diabetologia*. 1994;37:639.
6. Amighi J, Sabeti S, Schlager O, Mlekusch W, Exner M, Lalouschek W, et al. Low serum magnesium predicts neurological events in patients with advanced atherosclerosis. *Stroke*. 2004 Jan;35(1):22-7.
7. Kaur J, Prabhu KM, Thakur LC. Serum magnesium levels in ischaemic cerebrovascular disorders: a case-control pilot study in north Indian population. *Journal of Pharmaceutical and Biomedical Sciences (JPBMS)*. 2012;17(17).
8. Antin SS, Kashinkunti M, Kataria AV, Dhananjaya M, Alevoor S. A Cross Sectional Study of Fasting Serum Magnesium Levels in the Patients with Type 2 Diabetes Mellitus and Its Relation to Diabetic Complications. *Sch J App Med Sci*. 2014; 2(2A):502-6.
9. Arpaci D, Tocoglu AG, Ergenc H, Korkmaz S, Ucar A, Onmez A, Yildirim M, Hurmeydan O, Tamer A. Associations of serum magnesium levels with diabetes and diabetic complications.
10. Yang SJ, Hwang SY, Baik SH, Lee KW, Nam MS, Park YS, Woo JT, Kim YS, Park S, Park SY, Yim CH. Serum magnesium level is associated with type 2 diabetes in women with a history of gestational diabetes mellitus: the Korea National Diabetes Program study. *Journal of Korean medical science*. 2014 Jan 1;29(1):84-9.