International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Serum Magnesium Levels and its Correlation to Glycemic Control and Retinopathy in Type II Diabetes Mellitus

Dr. K Meena[1], Dr. S V R Murthy[2]

Abstract: ***Diabetes mellitus (DM) is a complex metabolic disease caused by a variable interaction between hereditary and environmental factors. It is associated with a considerable mortality from a variety of complications, which tend to worsen over time and carries a significant premature mortality risk. Diabetic retinopathy (DR) is a sight threatening complication of diabetes mellitus and is one of the leading causes of acquired blindness in adults. Hypomagnesemia has long been known to be associated with diabetes mellitus. Hypomagnesemia has long been known to be associated with diabetes mellitus. This association between diabetes mellitus and magnesium is said to have a wide range of impact on diabetic control and complications. The aim of the study was to assess the incidence of hypomagnesemia among non critically ill patients of Type 2 diabetes mellitus and to evaluate the relation of hypomagnesemia to glycemic control and retinopathy of diabetes mellitus. From the results of the present study, it can be concluded that estimation of glycemic levels and serum magnesium can help us predict the onset and progression of diabetic retinopathy.***

Keywords: diabetes mellitus, hypomagnesemia, diabetes retinopathy

Diabetes mellitus (DM) is a complex metabolic disease caused by a variable interaction between hereditary and environmental factors. It is associated with a considerable mortality from a variety of complications, which tend to worsen over time and carries a significant premature mortality risk. Its main features are abnormal insulin secretion, high levels of blood glucose and variety of complications such as retinopathy, nephropathy, neuropathy and arteriosclerosis[1,2].

Diabetic retinopathy (DR) is a sight threatening complication of diabetes mellitus and is one of the leading causes of acquired blindness in adults. The chance of losing the sight is about 25 times higher compared to normal individuals. There are a series of risk factors related to the development and progression of diabetic retinopathy such as duration of diabetes mellitus, poor glycemic control, dyslipidemia, hypertension and hypomagnesemia[1,3].

Hypomagnesemia has long been known to be associated with diabetes mellitus. Hypomagnesemia has long been known to be associated with diabetes mellitus. This association between diabetes mellitus and magnesium is said to have a wide range of impact on diabetic control and complications[4,5].

Chronic hyperglycemia and its associated non-enzymatic glycation plays an important role in the development of microangiopathy. Intensive glycemic control as measured by serum HbA1c levels have been demonstrated in randomised trials to reduce diabetic complications especially microvascular disease[6].

Several studies have been done to study the influence of these individual risk factors on the progression of retinopathy. However, very few studies have been done to study the correlation between all these risk factors in diabetic patients with retinopathy[3]. In this study, an attempt was made to find the correlation between risk factors in the onset and progression of diabetic retinopathy.

The aim of the study was to assess the incidence of hypomagnesemia among non critically ill patients of Type 2 diabetes mellitus and to evaluate the relation of hypomagnesemia to glycemic control and retinopathy of diabetes mellitus. It was a cross sectional study, including all non critical type II Diabetes mellitus(duration>5 years)patients who have presented to the outpatient services to the Department of General Medicine at a private medical college in Rajamahendravaram between November 2015 and April 2017. Patients on drugs altering magnesium levels or conditions like malabsorption, diarrhoea or adrenal dysfunction were excluded from the study. The selected individuals were tested for fasting and post prandial sugars, serum magnesium levels and complete ophthalmological examination.

- A total of 163 individuals were included in the study. Overall mean age of the population was 55.72 years(Range=39-75 years). Male:Female=1.1:1. Of the individuals tested, 54% of the individuals had Diabetic Retinopathy. When eye condition was compared among males and females, it was observed that 58.1% of females had diabetic retinopathy (41.9% females had normal fundus) as compared to 49.4% .
- The overall average duration of Diabetes among the cases was 7.09 years with SD of 2.7.Mean duration of diabetes among Diabetic retinopathy group was 7.95years and among normal group it was 6.07 years. On performing unpaired T test, this difference was found to be statistically significant ($P < 0.05$) which shows that cases with long duration history of diabetes had risk of diabetic retinopathy
- The overall average duration of Diabetes among the cases was 7.09 years with SD of 2.7.Mean duration of diabetes among low magnesium group was 8 years and among normal magnesium group it was 6.49 years. On performing unpaired T test, this difference was found to be statistically significant ($P < 0.05$) which shows that cases with long duration history of diabetes had low serum magnesium levels.
- On performing Pearson's correlation between duration of diabetes and serum magnesium levels, we have obtained a negative correlation coefficient of -0.218, which means

that as duration of diabetes increases serum magnesium levels are decreasing in our study population. However this trend was found to be statistically significant ($P < 0.05$)

- When magnesium levels were compared among cases with Diabetic retinopathy and those with normal fundus, it was observed that 48.9% of diabetic retinopathy patients were in the low magnesium group (51.1% were in the normal magnesium group) as compared to 28% of cases with normal fundus in the low magnesium group (72% were in the Normal magnesium group). Upon performing chi square test, this difference between cases with diabetic retinopathy and those with normal fundus was found to be statistically significant ($P < 0.05$).
- This study did not show any statistically significant correlation between gender, age and diabetic retinopathy.
- This study also did not show statistically significant correlation between gender, age and serum magnesium levels.

Our study was limited by the measurement of FBS/PPBS levels which indicate transient glycemic levels rather than HbA1c which is a more reliable indicator (indicating the glycemic status over a period of 3 months). Based on the results of the present study and data available from literature, it can be implicated that glycemic levels, hypomagnesemia are involved in the development of diabetic retinopathy. Hyperglycemia leads to the formation of advanced glycation end products, which result in the various micro vascular complications. Magnesium depletion is said to have a negative impact on glucose homeostasis and insulin sensitivity in diabetic patients as well as on the development and progression of complications such as retinopathy.

From the results of the present study, it can be concluded that estimation of glycemic levels and serum magnesium can help us predict the onset and progression of diabetic retinopathy. Early diagnosis and prompt treatment of the complications of diabetes mellitus, such as retinopathy, can improve the quality of life and increase life expectancy.

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