

Original Article

FREQUENCY OF HYPOMAGNESEMIA IN PATIENTS WITH DIABETIC RETINOPATHY

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Objective: To determine the frequency of hypomagnesemia in patients with diabetic retinopathy at a tertiary care hospital.

Methods: A cross sectional study was carried out. 135 cases fulfilling the inclusion/exclusion criteria were enrolled from Medical and Ophthalmology OPD Services Institute of Medical Science, Lahore. An informed consent of the patients was taken from the patients to include their data in the study. Detailed history for Diabetic Retinopathy and physical examination was done by ophthalmoscope. Blood samples were collected for measurement of fasting serum magnesium. The frequency of hypomagnesemia (according to operational definition) in patients with diabetic retinopathy was noted, all this information was recorded. Hypomagnesemia was defined as serum magnesium levels less than 1.5 mg/dl.

Results: In our study, out of 135 diabetic retinopathy cases, 32.59% (n=44) were between 30-50 years of age while 67.41% (n=91) were between 51-80 years of age, mean+sd was calculated as 56.37+12.24 years, 53.33% (n=72) were male and 46.67% (n=63) were females, frequency of hypomagnesemia in patients with diabetic retinopathy was recorded as 30.37% (n=41) while 69.63% (n=94) were not recorded with this morbidity.

Conclusions: The frequency of hypomagnesemia is high among patients with diabetic retinopathy. So, it is recommended that every patient who presents with diabetic retinopathy, should be tested for hypomagnesemia. However, it is also required that every setup should have their surveillance in order to know the frequency of the problem.

Keywords: diabetic retinopathy, serum magnesium frequency.

Introduction

Diabetes mellitus (DM) is a major health concern in Pakistan. Our country is considered in top ten countries with highest frequency of DM in its population. In 2025 Pakistan may cross 10 million people with diabetes mellitus in its population.¹ Around 10% of the people suffering from type II diabetes mellitus are having >30 years of age.² Patients with diabetes mellitus may have serious eye disease without developing any symptoms and leads to irreversible vision loss.³

Diabetic Retinopathy (DR) is one of the many ocular complications of DM and it is a major risk factor of blindness. An early diagnosis and a good glycaemic control, the long-term sequelae from DM may be controlled by regular screening and proper management. As the frequency of DM is increasing in country so the frequency of diabetic retinopathy is also increasing.⁴

Magnesium is the eighth most common element in the crust of Earth, fourth most abundant cation in the human body and second abundant intracellular cation. In diabetics there is a direct relationship between serum magnesium level and cellular glucose disposal that is independent of insulin

secretion. Magnesium deficiency has been found to be associated with diabetic micro and macrovascular disease.⁵ Low serum magnesium level correlated positively with the velocity of regaining basal vascular tone after hyperemia. Hypomagnesemia has been demonstrated in patients with diabetic retinopathy, with lower magnesium levels predicting a greater risk of severe diabetic retinopathy.⁶ prevalence of hypomagnesemia has been found to vary widely, depending on the patient's clinical condition. In a general population, 6.9% of patients were shown to be hypomagnesemic.⁷ In hospital inpatients on a medical-surgical floor, there was a prevalence of 11%, while in the intensive care unit it was found to be 20%. In a postoperative intensive care unit setting, the prevalence was 60%. A study of diabetic patients established a prevalence of 25%.⁸ We did a 2-month period prevalence study of magnesium levels for 120 patients in an urban minority clinic and found that 24% of hypertensive patients and 25% of diabetic patients were hypomagnesemic.

A recent study⁹ recorded hypomagnesemia in 55.26% of the patients of diabetic retinopathy while another recent study¹⁰ recorded in 10% of the cases with diabetic retinopathy; both the studies were conducted

The rationale of the study is that no local study is conducted to determine the frequency of hypomagnesemia in diabetic retinopathy while the international studies are also showing a significant variation, however the results of the current study will clarify the above variation in our targeted population and also record the exact frequency, as a large majority of patients are not diagnosed or remain undiagnosed for hypomagnesemia among these cases, the results of the study would also be helpful for timely management of the morbidity.

Methods

The study was conducted in Department of Ophthalmology and Internal Medicine, Services Institute of Medical Sciences, Lahore. It was a cross sectional study with a Non-probability Consecutive Sampling Technique Sample size of 135 cases was calculated with 95% confidence level 55% margin of error and taking expected %age of hypomagnesemia i.e.10%in patients with diabetic retinopathy. All diagnosed cases of diabetic retinopathy (according to operational definition) diagnosed at least 6 months ago having age between 30-80 years and either gender were included.

Already diagnosed cases and under treatment for hypomagnesemia (on history and medical record) and patients who were not willing to participate in the study were excluded. 135 cases fulfilling the inclusion/exclusion criteria were enrolled to determine the frequency of hypomagnesemia in patients with diabetic retinopathy at a tertiary care hospital. Serum magnesium level <1.5mg was confirmed through hospital laboratory on presentation of cases with diabetic retinopathy.

Result

Age distribution of the patients was done showing that 32.59%(n=44) were between 30-50 years of age while 67.41%(n=91) were between 51-80 years of age, mean+sd was calculated as 56.37+12.24 years. **(Table-1)** Patients were distributed according to gender showing that 53.33%(n=72) were male and 46.67%(n=63) were females. **(Table-2)** Mean magnesium level was calculated as 1.59+0.23 mg. **(Table-3)** Frequency of hypomagnesemia in patients with diabetic retinopathy was recorded as 30.37%(n=41) while 69.63%(n=94) were not recorded with this morbidity. **(Table-4)** Stratification for hypomagesemia in patients with diabetic retinopathy with regards to age and gender was

Table-1: Age distribution (n=135) done and presented in **(Table-5&6)** respectively.

Age (in years)	No. Of Patients	Percentage (%)
30-50	44	32.59%
51-80	91	67.41%
Total	135	100%
Mean±SD	56.37±12.24	

Table-2: Gender distribution (n=135).

Gender	No. Of Patients	Percentage (%)
Male	72	53.33%
Female	63	46.67%
Total	135	100%

Table-3: Mean magnesium level (n=135).

Magnesium Level (mg)	Mean	SD
	1.59	0.23

Table-4: Frequency of hypomagnesemia in patients with diabetic retinopathy (n=135).

Hypomagnesemia	No. Of Patients	Percentage (%)
Yes	41	30.37%
No	94	69.63%
Total	135	100%

Table-5: Stratification for frequency of hypomagnisemia with regards to age.

Age (in years)	Hypomagnisemia		P-Value
	Yes	No	
30-50	10	37	0.17
F51-80	31	30	

Table-6: Stratification for ventilator associated hypomagnisemia in children with regards to gender.

Gender	Hypomagnisemia		P-Value
	Yes	No	
Male	17	55	0.06
Female	24	39	

Discussion

Diabetic retinopathy is the result of microvascular retinal changes. In addition damage to non-vascular structures also contributed to the retinopathy

basement membrane lead to incompetence of the vascular walls. These damages change the formation of the blood retinal barrier and also make the retinal blood vessels become more permeable. Magnesium deficiency has been found to be associated with diabetic micro vascular disease. Low serum magnesium level correlated positively with the velocity of regaining basal vascular tone after hyperemia. Hypomagnesemia has been demonstrated in patients with diabetic retinopathy, with lower magnesium levels predicting a greater risk of severe diabetic retinopathy.

This study was planned with the view that no local study is conducted to determine the frequency of hypomagnesemia in diabetic retinopathy while the international studies are also showing a significant variation, however the results of the current study will clarify the above variation in our targeted population and also record the exact frequency, as a large majority of patients are not diagnosed or remain undiagnosed for hypomagnesemia among these cases, the results of the study would also be helpful for timely management of the morbidity.

In our study, out of 135 diabetic retinopathy cases, 32.59%(n=44) were between 30-50 years of age while 67.41%(n=91) were between 51-80 years of age, mean \pm sd was calculated as 56.37 \pm 12.24 years, 53.33%(n=72) were male and 46.67%(n=63) were females, frequency of hypomagnesemia in patients with diabetic retinopathy was recorded as 30.37%(n=41) while 69.63% (n=94) were not recorded with this morbidity.

The findings of our study are nearly in agreement with a recent study⁹ recorded hypomagnesemia in 55.26% of the patients of diabetic retinopathy while another recent study¹⁰ recorded in 10% of the cases with diabetic retinopathy; both the studies were conducted in India and published in 2014, which is not in agreement with our study.

Cellular magnesium deficiency can alter the activity of the membrane bound sodium-potassium ATPase which is involved in the maintenance of

the gradient of sodium, potassium and glucose transport. Low levels of magnesium can reduce the secretion of insulin by the pancreas.¹² In diabetes, there is a direct relationship between the serum magnesium levels and the cellular glucose disposal, which is independent of the insulin secretion. This change in the glucose disposal has been shown to be related to the increased sensitivity of the tissues to insulin in the presence of adequate magnesium levels.¹³ Magnesium activates more than 300 enzymes in the body and it is a critical co factor of many enzymes in the carbohydrate metabolism. Observations have revealed a definite lowering of the serum magnesium levels in diabetic patients with retinopathy, especially in those with poorly controlled glucose levels.

deValk HW et al¹⁴ reported progression of diabetic retinopathy was related to plasma magnesium concentration (p<0.05), and association between serum magnesium concentration and progression of retinopathy remained even after confounding HbA1c levels and duration of diseases (p^Q<0.03). But in our present study we found strong correlation between duration of disease and low serum magnesium levels.

The results of our study clarify the variation in different studies in our targeted population and also recorded the exact frequency, a large majority of patients are not diagnosed or remain undiagnosed for hypomagnesemia among these cases, the results of the current study are helpful for timely management of the morbidity.

Conclusion

The frequency of hypomagnesemia is high among patients with diabetic retinopathy. So, it is recommended that every patient who present with diabetic retinopathy, should be tested for hypomagnesemia. However, it is also required that every setup should have their surveillance in order to know the frequency of the problem.

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Picture Quiz

WHAT IS THE DIAGNOSIS?

1. Epidermolysis bullosa
2. Hereditary haemorrhagic telangiectasia
3. Neurofibromatosis
4. Peutz-Jeghers syndrome
5. Scleroderma



Seen answer on page 42