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DIABETIC FOOT ULCER;

FREQUENCY OF HYPOMAGNESEMIA IN PATIENTS WITH DIABETIC FOOT ULCER

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ABSTRACT... Objectives: To determine the frequency of hypomagnesemia in patients with diabetic foot ulcer. **Study Design:** Cross sectional descriptive nature. **Setting:** Liaquat University Hospital Jamshoro / Hyderabad. **Period:** 29-09-2016 to 28-03-2017. **Patients and Methods:** The patients with history of diabetes mellitus (known cases) for more than 3 years duration had diabetic foot ulcer for ≥ 02 weeks duration, of 30-60 years of age & either gender were recruited and evaluated for serum magnesium level while the data was analyzed in SPSS 16. **Results:** Total 100 patients with diabetic foot ulcer were evaluated for hypomagnesaemia. The mean age ±SD of age (years), duration of diabetes (years) and foot ulcer (weeks), BMI (kg/m^2), hypertension (systolic and diastolic mmHg), HBA1C and magnesium for whole population was 52.86±6.87, 6.95±1.85 and 5.86±2.31, 31.92±2/43, 150.38±10.52 and 95.97±5.97, 9.96±2.73 and 1.16±0.95 respectively. Out of one hundred, 55% were males and 45% were females. The hypertension, smoking, dyslipidemia, obesity, raised HBA1C and hypomagnesemia was found in 65%, 59%, 59%, 55%, 56% and 67%. **Conclusion:** Hypomagnesemia detected in subjects with type 2 diabetes mellitus having foot ulcers.

Key words: Diabetes Mellitus, Foot Ulcer, Hypomagnesemia, Magnesium.

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INTRODUCTION

Magnesium is an element regulates ion channels and act as co-enzymat in different chemical reactions responsible for energy metabolism, protein synthesis and neuromuscular transmission.[1-3]

Diabetes mellitus (DM) is a common issue worldwide and become an important public health problem due to its life threatening complications. One of its major complication is diabetic foot ulcers leading cause of hospitalization in develop as well as under develop countries and a major burden for various morbidities.[4,5] The pathophysiology of chronic diabetic foot ulcers is complicated but well understood as macro and mirco vasculature pathogenesis play key role in development of foot ulcer and delayed wound healing in diabetic population.[6]

The magnesium deficiency reported among type 2 diabetic patients and can impair sugar homeostasis and insulin sensitivity.[7-9]

The reported international prevalence for hypomagnesemia in diabetic foot ulcer is 93% in the study by Rodriguez-Moran M, et al.[10] Dasgrupta et al. study, observed the prevalence of 58.5% for hypomagnesemia in individuals with diabetic foot ulcer while in an Indian study it was reported as 87.5%.[11,12] In Pakistan the studies were conducted on magnesium level in diabetes mellitus,[13,14] but there was no any local study conducted on hypomagnesemia in patients with diabetic foot ulcer and the data regarding hypomagnesaemia in said has been still scarce. Although one study published in Pak J Med Sciences (2013) but was conducted at Turkey.[15] Therefore, by considering such variations in the reported prevalence by former studies, this study was focused and relevant to generate the local data by investigating the magnitude of hypomagnesemia in patients with diabetic foot ulcer so that patients can be prospectively rationalized and then managed accordingly based on the findings of present study.

PATIENTS AND METHODS

The cross sectional descriptive study of six month (from 29-09-2016 to 28-03-2017) was conducted at Liaquat University Hospital Hyderabad / Jamshoro. The inclusion criteria of the were the patients with history of diabetes mellitus (known cases) for more than 3 years duration had diabetic foot ulcer for ≥ 02 weeks duration, of 30-60 years of age and either gender while the exclusion criteria of the study were foot ulcer due to reason other than diabetes mellitus such as tuberculous ulcers, vasculitic ulcers, malignant ulcer and ulcers due to burns.

All the participants have evaluate for hypomagnesemia by taking 2 ml venous blood sample and is considered when serum magnesium level <1.5 mEq/L while the diabetic foot ulcer was labeled when there was presence of ulcer (break in the skin) on foot for >14 days duration consist of purulent drainage (yellow fluid) or gangrenous area (skin blackening) in known diabetic patients (having diabetes for more than 3 years duration) detected by the gross examination (on clinical examination). The sample size was calculated according to the reported prevalence for prevalence of hypomagnesaemia in diabetic foot ulcer 93.9%, [10] and the informed consent was taken from the participants and the data was analyzed in SPSS 21 while the stratification was done for age, gender, residence (urban or rural), HBA1C in relation to diabetic foot ulcer as well as to control the confounders whereas by applying the Chi-square test the mean ±SD, frequencies and percentages were calculated and the level of significance was taken as $p \leq 0.05$.

RESULTS

During six months study period, total one hundred individuals with diabetic foot ulcer were evaluated for hypomagnesaemia. The mean age ±SD of age (years), duration of diabetes (years) and foot ulcer (weeks), BMI (kg/m^2), hypertension (systolic and diastolic mmHg), HBA1C and magnesium for whole population was 52.86±6.87, 6.95±1.85 and 5.86±2.31, 31.92±2/43, 150.38±10.52 and 95.97±5.97, 9.96±2.73 and 1.16±0.95 respectively. The results are presented in cross tabulation in Table-I-IV.

Parameter	Frequency (n=100)	Percentage (%)
Age (Yrs)		
30-40	28	28.0
41-50	47	47.0
51-60	25	25.0
Gender		
Male	55	55.0
Female	45	45.0
Residence		
Urban	45	45.0
Rural	55	55.0
Duration of Diabetes mellitus (years)		
3-5	20	20.0
5-8	53	53.0
> 8	27	27.0
Duration of Foot Ulcer (weeks)		
2-4	26	26.0
4-6	46	46.0
>6	28	28.0
Hypertension		
Yes	65	65.0
No	35	35.0
Smoking		
Yes	59	59.0
No	41	41.0
Dyslipidemia		
Yes	59	59.0
No	41	41.0
Obesity		
Yes	55	55.0
No	45	45.0
Raised HBA1C		
Yes	56	56.0
No	44	44.0
Hypomagnesemia		
Yes	67	67.0
No	33	33.0

Table-I. The demographical, etiological and clinical parameters of study population

		Hypomagnesemia		Total
	Age (yrs)	Yes	No	
	30-40	25	3	28
		37.3%	9.1%	28.0%
	41-50	23	24	47
		34.3%	72.7%	47.0%
	51-60	19	6	25
		28.4%	18.2%	25.0%
Total		67	33	100
		100.0%	100.0%	100.0%

Table-II. The distribution of age and hypomagnesemia
***P-value: 0.001; statistically significant**

		Hypomagnesemia		Total
	Gender	Yes	No	
	Male	38	17	55
		56.7%	51.5%	55.0%
	Female	29	16	45
		43.3%	48.5%	45.0%
Total		67	33	100
		100.0%	100.0%	100.0%

Table-III. The distribution of gender and hypomagnesemia
***P-value: 0.62; statistically non significant**

		Hypomagnesemia		Total
	Raised HBA1C	Yes	No	
	Yes	47	9	56
		70.1%	27.3%	56.0%
	No	20	24	44
		29.9%	72.7%	44.0%
Total		67	33	100
		100.0%	100.0%	100.0%

Table-IV. The distribution of HBA1C and hypomagnesemia
***P-value: <0.01; statistically significant**

DISCUSSION

Hypomagnesemia is a risk factor for retinopathy, foot ulcerations, cardiovascular and cerebrovascular disorders, retinopathy, foot ulcer and peripheral neuropathy.[16,17] In present study, there was significant decrease in serum magnesium level in type 2 DM having foot ulcers and it is consistent with former literature.[18-20] Additionally, serum magnesium inversely proportional to HBA1C and blood sugar level. The results of present study are consistent with former studies.[21-23] The low magnesium level can worsen the glycaemic status in diabetes mellitus and micro and macrovascular due to persistent hyperglycemia is linked to spread of complications.[24,25]

The dyslipidemia was also observed in present study population. Furthermore, Guerrero-Romero, et al and Rodriguez-Moran, et al studies found an association between low magnesium and lipoproteins.[26,27] It has been observed that the raised HBA1C and lipoprotein levels in current series directly proportional to hyperglycemia, insulin resistance and uncontrolled diabetes mellitus due to magnesium deficiency, the observations are consistent with the findings reported by Srinivasan et al.[28] The present study results suggested that low magnesium levels are associated with the duration of diabetes and foot ulcers; and the Haquea et al. study found the strong relationship between diabetes mellitus and its duration.[29] Furthermore it has been detected the low serum magnesium level is responsible for persistent hyperglycemia and dyslipidemia leads to atherosclerosis and that is again risk factor for peripheral vascular disease and foot ulceration.[30] Hypomagnesemia again directly proportional to blood pressure, oxidative stress and thickness in carotid vasculatures and ischemic heart diseases.[31] The factors for low serum magnesium in diabetic population includes increase GI loss due to autonomic disturbance, reduce dietary intake, renal loss as dieresis because of glycosuria, excessive usage of antibiotics, antifungal medications, chemotherapeutic agents and impaired renal reabsorption. As mentioned in previous literature that worst outcome is associated with low serum magnesium level, thus magnesium levels should be monitored in diabetic population, routine screening for hypomagnesemia should be advised and the disturbance should be treated on priority basis.[32]

CONCLUSION

The magnesium deficiency is identified as a positive correlation with glycemic status, raised hemoglobin A1C (HBA1C) responsible for foot ulcers in type 2 diabetic population. Therefore,

the magnesium levels should be screened and monitored in individuals with diabetes mellitus with foot ulcers as far as management strategies are concerned.

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The key of successful leadership today is influence, not authority.

– Ken Blanchard –

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Zohaib Feroz	Contribution to conception and design, acquisition of data, analysis and interpretation.	
2	Abdul Raheem Memon	Drafting the article and shares its expert research opinion and experience in finalizing the manuscript.	
3	Nisar Ahmed Shah	Contributed in conception and interpretation of data and give his expert view for manuscript designing.	
4	Syed Zulfiquar Ali Shah	Collection and acquisition of data, analysis and interpretation of data and make it suitable for final revision and a corresponding author.	