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Original Article

Relationship between HbA1c with Hypoglycaemic Attack and Diabetic Complications of Patients Admitted in a Tertiary Hospital

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Abstract

Background: *Hypoglycemia is a major complication of diabetes mellitus and common causes of admission in hospital. Those who have long duration of diabetes having poor glycemic control, frequently experienced such events were self treated at home. The present study pointed to identify whether hemoglobin A1c (HbA1c) a marker of average plasma glucose, relates with severe hypoglycemia and diabetic complications or not.*

Materials and methods: *A retrospective observational study was conducted in the Department of Medicine, Maa-Shishu-O-General Hospital, Agrabad, Chattogram from April 2019 to September 2021. Total 36 patients were selected, as presenting in Medicine Department with documented hypoglycaemia. All data was taken meeting exclusion criteria and analysed.*

Results: *Hypoglycaemic episodes mostly occurred in elder cases (>61 year of ages) n=16, 44% and HbA1c mostly belongs to between 7.6 to 8 groups. Confusion is the most common presentation, N=63, 63.9%. Neuropathy was found as common complication, (30.6% , n=11) cases and most of the neuropathy found in HbA1c 7.6 to 8.5 groups 54.54% , n=6 . Most of the patients were taking sulfonylurea group of drugs 47.2% , n=17, and mixed acting insulin n=21 ,58.3%.*

Conclusion: *Hypoglycemic admission is not related to extensive Diabetic control rather with related to elder patients , various Diabetic complications and injudicious use of ant diabetic agents.*

Key words: Diabetic Neuropathy; Diabetic Retinopathy; Oral hypoglycaemic agents.

INTRODUCTION

The global prevalence of type 2 diabetes has shown an alarming rise over years. 537 million adults (20-79 years) are living with diabetes - 1 in 10. This number is predicted to rise to 643 million by 2030 and 783 million by 2045. Over 3 in 4 adults with diabetes live in low- and middle-income countries.[1] Hypoglycemia is defined as a reduction in plasma glucose concentration to a level that may induce symptoms or signs such as altered mental status and/or sympathetic nervous system stimulation. This condition is revealed as abnormalities in the mechanisms involved in glucose homeostasis. The most common cause of hypoglycemia in patients with diabetes related to excess dose of insulin and certain OHA. Multiple co morbidities such as renal insufficiency/failure, alcoholism, hepatic cirrhosis/failure, other endocrine diseases, or recent surgery may be contributed. The glucose level at which an individual becomes symptomatic is highly variable (Threshold generally at < 50 mg/dL). ADA and Endocrine Society workgroup concluded 70 mg/dl (3.9 mmol/l) of capillary blood glucose as an acceptable alert level for detection of hypoglycaemia.[2]

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Hemoglobin A1c (HbA1c) is a good indicator of chronic hyperglycemia and it can reflect an integrated index of glycaemia over the past 120-day lifespan of the red blood cell. The HbA1c test is one of the tools to diagnose as diabetes If this level become 6.5% or exceeds it. Some studies show that higher A1c is associated with increased risk of hypoglycemia, while others show an inverse relationship, with lower A1c associated with increased risk.[3,4]

HbA1c is one of the diagnostic criteria of Diabetes from last decade, as it has no diurnal variability, not depend on acute illness and done in any time independent of fasting but HbA1c method is certified by

the National Glycohemoglobin Standardization Program (NGSP) and is traceable to the Diabetes Control and Complications Trial (DCCT) reference assay. The present study pointed to identify whether hemoglobin A1c (HbA1c), a marker of average plasma glucose, relates with severe hypoglycemia and diabetic complications or not.

MATERIALS AND METHODS

A retrospective observational study was conducted in the Department of Medicine, Maa-Shishu-O-General Hospital, Chattogram from April 2019 to September 2021. Total 36 patients were selected, as presenting in Medicine Department with documented hypoglycaemia and symptoms. After correction of hypoglycaemia, oral and written informed consent was taken . After taking proper elaborative history regarding duration of diabetes ,existing complications were sought and noted, details drug history were searched including compliance. Relevant investigations and invariably HBA1c was done and results were analyzed. Hypoglycaemia was diagnosed as blood sugar level below 70 milligrams per deciliter (mg/dL), or 3.9 millimoles per liter (mmol/L). All patients were admitted in other units and transferred to medicine ward were not included. Severe hypoglycaemic patient with unremitting episodes after conservative treatment and later transferred to ICU were not included. All demographic data, etiology, complications and details treatment outcome was recorded and analyzed by software SPSS 20.

RESULTS

Elder patients (>61 years) are more vulnerable to hypoglycaemia, n=16, 44% than adult age group (31-40 years) n=1. 2.7%. In elder group (>61 years) HbAIc Is found well controlled only in 18.75% n=3 cases and similar number of patients belongs to HbAIc 6.6 to 7.5 groups. Highest number of patients belongs to 7.6 to 8.5 HbAIc group 43%. n=7. Regarding complications, Neuropathy was found in 30.6%, n=11 cases and most of the neuropathy found in HbA1c 7.6 to 8.5 groups 54.54%, n=6 . Nephropathy occurs in 27.8%, n=10, and most of the patients belongs to HbA1c 7.6 to 8.5 groups 11.1%, n=4. Similarly Cerebrovascular diseases occurs in 27.8%, n=10, and most of the patients belongs to HbA1c 7.6 to 8.5 groups 11.1%, n=4.

One fourth patients presented with Cardiovascular diseases 25%, n=9 but most patients belongs to controlled HbA1c level, probably patients were suffered from cardiovascular diseases before onset of Diabetes.

Most of the patients were taking sulfonylurea group of drugs 47.2%, n=17 and mixed acting insulin n=21 ,58.3%. Other oral agents such as DPPV4 inhibitors N=10, 27.8% ,was less commonly used probably due to cost.

Table I Relationship between age distribution group to HbA1c subgroup

		HbAIc subgroup				
		Below 6.5	6.6 to 7.5	7.6 to 8.5	Above 8.6	Total
Age group	31-40 years	0	0	1	0	1
	41-50 years	3	2	3	1	9
	51-60 years	2	8	0	0	10
	>61 years	3	3	7	3	16
Total		8	13	11	4	36

Table II Distribution of common presentations

	Frequency	Percent
Confusion	23	63.9
Vertigo	9	25.0
Headache	5	13.9
Unconsciousness	7	19.4
Tremor	6	16.7
Sweating	6	16.7
Palpitation	5	13.9

Table III Complication profiles of study group

Complication	Frequency	Percentage	p value	Correlation
Neuropathy	11	30.6	0.976	-.005
Nephropathy	10	27.8	.258	-.194
Cerebrovascular disease	10	27.8	.537	-.106
Cardiovascular diseases	9	25	.279	.185
Retinopathy	7	19.4	.139	-.251
CKD	5	13.9	.129	.258

Table IV Relationship between age distribution groups to Diabetic complications

		Cardiovascular diseases	Neuropathy	Cerebrovascular diseases	Nephropathy	Retinopathy	CKD
Age group	31-40 years	0	1	0	0	1	0
	41-50 years	1	2	2	1	1	0
	51-60 years	2	2	3	3	1	1
	>61 years	6	6	5	6	4	4
Total		9	11	10	10	7	5

Table V Distribution of anti diabetic agents

	Frequency	Percent
Sulfonylurea	17	47.2
Biguanide	15	41.7
DPP 4 Inhibitors	10	27.8
Alpha 1 Glucosidase inhibitors	1	2.8
SGLT2 inhibitors	8	22.2
Short Acting insulin	5	13.9
Mixed acting insulin	21	58.3
Long acting insulin	4	11.1
Ultra short acting insulin	7	19.4
Ultra Long acting analog	5	13.9

DISCUSSION

In this study, hypoglycemia is more prone to elder , female group of patients and suffered from long duration of DM. Elder patients (More than 61 year of ages) were 44.4%, n=16 , female patients are 52.8%, n=19 more vulnerable to hypoglycaemic attack and mean duration is 10.69 year and median duration is 10 years and p value is 0.00. But recent one large group study, results showed more hypoglycaemia occurred in female and long duration of Diabetes but they in younger patients.[5] HbA1c proportionately increases with age. In elder group of patients, more than 61 years, most belongs to HbA1c 7.6 to 8.5 groups 43.7%, n=7, comparative to ages between 51 to 61 years belongs to HbA1c 6.6 to 7.5 groups 80%, n=8. One study showed that an increase of HbA1c of 0.153% (1.7 mmol/mol) per decade in men and a comparable increase of 0.191% (2.1 mmol/mol) per decade in women in the non Diabetic patient also.[6] Incidence of hypoglycaemic episode is more in patient taking sulfonylurea (n=17, 47.2%) comparative to next in biguanide group (n=15, 41.7%).

Metformin and SU were the most commonly documented concomitant OAD, identified in 50.9% (95% CI: 47.6%-54.2%) and 39.2% (95% CI: 34.8%-43.6%) respectively, of estimated ED visits for insulin-related hypoglycemia.[7]

Signorovitch et al showed that the use of SU (38.2 %), biguanide (56.3%) and thiazolidinediones (TZD) (14.5%) were highly associated with the development of severe hypoglycemia.[8] In this study hypoglycaemia is more experienced in mixed acting insulin receiver group (n=21, 58.3%) that is widely available and commonly prescribed due to low cost in our country .

In the survey by Geller et al, an estimated 22.9% of ED visits for insulin-related hypoglycemia, more than 1 type of insulin product was documented.[9] Long-acting (32.9%) and rapid-acting (26.4%) products were the most commonly documented insulin product types.

Many studies have been carried out showing the relationship between diabetic complications and HbA1c. In our study showed that most complications observed in HbA1c group between 7.6% and 8% comparing to another study complications increases with HbA1c, with a statistically significant raise in patients with HbA1c between 7 and 7.9% compared to those with values between 6 and 6.9% ($p<0.0001$) and the strongest correlations were found between DR and HbA1c ($r=0.64$, $p<0.001$) and between DN and HbA1c ($r=0.61$, $p<0.001$). In this study mild positive correlation was found between CKD, Cardiovascular diseases and neuropathy with HbA1c but other complications was found negative correlation with HbA1c.[10]

We thought that the reason for this might be related to the low sample size in our study, unlike the previous study, was conducted in patients admitted with only hypoglycemic patients rather than random patients.

CONCLUSION

As elder peoples are more vulnerable to hypoglycaemia,so more frequent follow up is required regarding glycaemic control, proper treatment of other comorbidities and choosing antidiabetic agents depending on patients convenience, financial condition , avoiding polypharmacy, proper caring and providing good diabetic educations.

DISCLOSURE

Both the authors declared no competing interest.

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