Section: General Medicine

Original Research Article

HYPOGLYCEMIA AWARENESS IN DIABETES MELLITUS PATIENTS ATTENDING A TERTIARY CARE CENTRE IN NORTH-EAST INDIA

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Received : 20/09/2024
Received in revised form : 01/11/2024
Accepted : 16/11/2024

Keywords:
Diabetes Mellitus, Hypoglycemia Awareness, Hypoglycemia Awareness Questionnaire, Hypoglycemic Agents.

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DOI: 10.47009/jamp.2024.6.6.48

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (6); 241-245

Abstract

Background: Hypoglycemia is a menace in diabetic patients that hinders optimal plasma glucose management. The study aims to examine the acquaintance of hypoglycemia within diabetes patients. The hospital-based cross-sectional study was carried out at the Regional Institute of Medical Sciences (RIMS), Imphal. **Materials and Methods:** A total of 193 diabetic patients participated in the study. To identify the magnitude of hypoglycemia awareness, the participants were assessed using Hypoglycemia Awareness Questionnaire. Statistical analysis used all the obtained data from the study were analyzed using IBM Statistical Package for Social Sciences (SPSS) Statistics, version 21. The variable mean, median and percentage were calculated. Association between variables were checked by applying Chi-square test, One-way ANOVA and Kruskal Wallis test. **Result:** Out of included participants, 25.9% were aware of hypoglycemia. There was a statistically significant hypoglycemia score with oral hypoglycemic drug treatment, insulin drug treatment and patients aware of the co-morbid condition (P> 0.05). In the oral hypoglycemic drugs treatment, 19.7% participants and 46.5% of insulin-receiving participants had hypoglycemia. **Conclusion:** Hypoglycemia was recognized by 25.9% patients according to the hypoglycemia score. There was a significant association for increasing age, longer duration of diabetes, type of treatment, presence of complications and diabetic control status with recognition of hypoglycemia.

INTRODUCTION

The global epidemic of diabetes became one of the biggest challenges to humankind. Globally, diabetes has emerged as a major public health concern. About 422 million people worldwide have diabetes.[1]The prevalence of diabetes in South East Asian region is 88 million and it is estimated to be 153 million by 2045.[2]The prevalence of diabetes mellitus in India is 8.9% in the 20-79 year age group and around 77 million are affected with diabetes mellitus and are expected to cross 123.5 million by 2040.[3]A study by the American Diabetes Association reports that India will see the greatest increase in people diagnosed with diabetes by 2030.[4]

Diabetes mellitus is a chronic condition that requires long-term medical attention to attain optimal glycemic control. However, maintaining healthy plasma glucose levels with glycemic agents intensifies the risk of hypoglycemia. Hypoglycemia offers a major hindrance in effective diabetic care. The hypoglycemic phobia associated with insulin or oral antihyperglycemic drug may hamper maximal glucose control in diabetes care.[5]To overcome the hypoglycemic aftereffect many diabetic patients voluntarily maintain the plasma glucose level above the standard guideline prescribed, ultimately contributing the risk of developing microvascular and macrovascular complications. Non-severe hypoglycemic incidents are unreported by patients and sometimes due to the scarcity of time many healthcare professionals also skip to ask about the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

hypoglycemic event during the consultation. Unawareness and mistreatment of hypoglycemic episodes at the initial stage could transform into severe recurrent hypoglycemia, even permanent morbidity or mortality.[6]

Therefore,we aim to determine the awareness of hypoglycemia among diabetic patients. The study also aims to evaluate the factors associated with hypoglycemia like duration of diabetes, type of treatment, glycemic control and diabetic complications.

MATERIALS AND METHODS

Study design: A hospital-based cross-sectional study was conducted among the patients with diabetes mellitus attending Endocrine OPD, Medicine OPD and Medicine wards of the Regional Institute of Medical Sciences (RIMS), Imphal.

Study setting: The study was conducted in Endocrine OPD, Medicine OPD and Medicine wards of the Regional Institute of Medical Sciences (RIMS), Imphal.

Study duration: The study was conducted for a duration of two years from October 2019 to September 2021.

Study population: All patients with diabetes mellitus attending Endocrine Clinic, Medicine OPD or admitted in Medicine ward.

Study Inclusion and Exclusion Criteria

Patients with Type 1 and Type 2 diabetes mellitus were included in the study.The exclusion criteria included endocrinopathies, chronic illness and psychiatric illness that would hinder the completion of questionnaire.

Sample size and sampling

Based on the prevalence of hypoglycemic awareness among diabetic patients attending endocrinology clinic as 14% with 5% absolute allowable error at 95% confidence level, the sample size was estimated to be 193 patients with diabetes mellitus.[7]

Ethical Clearance: Afterstudy approval from the Research Ethics Board, Regional Institute of Medical Sciences (REB RIMS), Imphal and acquiring informed consent from the study participants, all the included patients were subjected to comprehensive questionnaire, history taking, and clinical examination. All the data collected were documented in a pre-defined proforma for collecting the socio-demographic characteristics, clinical and disease characteristics.

Data collection

Demographic and clinical data: Patient's age, sex, body mass index (BMI), duration of diabetes mellitus, glycemic agents, fasting blood glucose level, glycosylated haemoglobin (HbA1c), family history of diabetes, and social habits (alcohol, smoking). A thorough prescription audit was carried out for the participants to analyze the use of drugs, and comorbid conditions.

Hypoglycemia Awareness Questionnaire: The Hypoglycemia Awareness Questionnaire from Hypoglycemia Health Association of Australia is a widely used tool for assessing hypoglycemia awareness. The questionnaire has 10 items with responses on the Likert scale namely never, rarely, occasionally and usually and the scores were given as 0, 1, 2 and 3 respectively. The scores obtained were then added as TOTAL SCORE based on which the following were assumed:if the total score was below 8 (hypoglycemia is unlikely), between 8 to 15 (hypoglycemia is possible), above 15 (hypoglycemia is present).

Statistical analysis: Data were analyzed using IBM Statistical Package for Social Sciences (SPSS) Statistics, version 21. Categorical variables like gender and family history are expressed as frequency and percentages. Continuous variables like age and duration of diabetes are presented as mean±SD and/or median (IQR), depending on the type of distribution. The chi-square test was used to determine the association between the categorical variables. One-way ANOVA/ Kruskal Wallis test was used to determine the association of continuous variables with hypoglycemia. A P value of less than 0.05 was considered statistically significant.

RESULTS

There were a total of 193 diabetic patients. The age, sex, and clinical data distribution characteristic of included subjects are shown in Table 1. The mean age of the study participants was 53±16.9 years. Majority of 56.5% study participants were males. Hypertension was present among 56% of the study participants. The mean BMI of the study participants was 24.4±4.6 kg/m2. Among the participants 19.7% were overweight and 37.3% were obese. Around 16.6% and 17.6% of the study participants presented with a history of alcohol use and tobacco use. In this sample 47.2% of the participants had a family history of diabetes. In the overall subjects 78.8% were on oral hypoglycemic and 44.6% were on insulin. In this sample 40.4% were maintaining fasting blood glucose level of 80 to 130 mg/dL and 22.8% of the participants had HbA1c < 7%. Twenty-six percent of the patients score more than 15 on the hypoglycemia questionnaire. There were 17.1% patients of deranged liver function test and 55.4% patients of deranged lipid profile. Overall, 52.3% of participants were having the awareness of concomitant disorder.

Our analysis suggested a presence of 27.5% and 28.7% of hypoglycemia in male and female participants [Table 2]. In the hypertensive diabetic subjects, 31 patients are present with hypoglycemia. Twenty-eight percent of subjects and thirty-two percent of alcohol and tobacco user diabetic patients had hypoglycemia. In the oral hypoglycemic drug treatment group 19.7% and 46.5% in the insulin-

ISSN (O): 2687-5365; ISSN (P): 2753-6556

receiving patients were reported with hypoglycemia. Among the diabetic patients with comorbid conditions reported 42.6% with hypoglycemia. There was a statistically significant hypoglycemia score with oral hypoglycemic drug treatment, insulin drug treatment and patients aware of the comorbid condition[Table 2].

Association of age, fasting blood glucose (mg/dl), and HbA1c % with hypoglycemia score were statistically significant [Table 3].

[Table 4] shows that the median duration of diabetes was longer for the patients with recognized symptoms of hypoglycemia and it was found to be statistically significant (p=0.003).

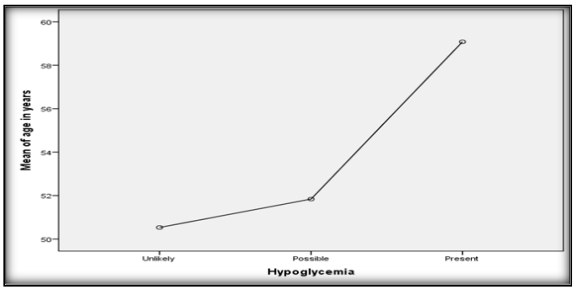

Figure 1: Mean plot showing the association of age with hypoglycemia score category (N=193)

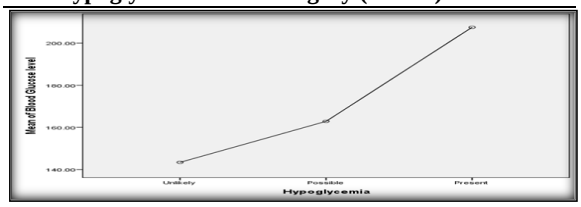

Figure 2:Mean plot showing the plasma glucose level with hypoglycemia score category (N=193)

Figure 3:Mean plot showing the HbA1c level with hypoglycemia score category (N=193)

Table 1: Distribution of Sample Characteristics.

Variables		**Distribution**
		Mean±SD
Age		53.5±16 .9
		N (%)
Total		193 (100)
Sex at birth	Female	84 (43.5)
	Male	109 (56.5)
BMI (kg/m2)	Underweight (<18.5)	15 (7.8)
	Normal (18.5-22.9)	68 (35.2)
	Overweight (23.0-24.9)	38 (19.7)
	Obese (≥25.0)	72 (37.3)
Duration of Diabetes (years)	< 5	100 (51.8)
	5 to<10	45 (23.3)
	10 to <15	18 (9.3)
	≥ 15	30 (15.6)
History of alcohol use		32 (16.6)
History of tobacco use		34 (17.6)
Family history of diabetes mellitus		91 (47.2)
Hypertension		108 (56)
Drugs	Oral hypoglycemic drugs	152 (78.8)
	Insulin	86 (44.6)
	Oral hypoglycemic drugs and Insulin	45 (23.3)
Fasting blood glucose: 80-130 mg/dL		78 (40.4)
HbA1c< 7 %		44 (22.8)
Hypoglycemia questionnaire	Unlikely (<8)	32 (16.6)
	Possible (8-15)	111 (57.5)
	Present (>15)	50 (25.9)
LFT	Normal	160 (83.9)
	Deranged	33 (17.1)
Lipid profile	Normal	86 (44.6)
	Deranged	107 (55.4)
Total Complications		101 (52.3%)
	Coronary artery disease	33 (17.1%)
	Cerebrovascular	28 (14.5%)
	Peripheral vascular disease	11(5.7%)
	Nephropathy	52 (26.9%)
	Neuropathy	46 (23.8%)
	Retinopathy	21 (10.9%)

SD: Standard deviation; BMI: Body mass index; HbA1c: Glycosylated haemoglobin; LFT: Liver function tests.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 2: Association of hypoglycemia score

	Hypoglycemia			P
	Unlikelyn (%)	Possiblen (%)	Presentn (%)	
Gender (n=193)				
Male	17 (15.6)	62 (56.9)	30 (27.5)	0.812
Female	15 (17.9)	49 (58.3)	20 (23.8)	
Hypertension (n=193)				
Yes	19 (17.6)	58 (53.7)	31 (28.7)	0.470
No	13 (15.3)	53 (62.4)	19 (22.4)	
Alcohol use (n=193)				
Yes	8 (25.0)	15 (46.9)	9 (28.1)	0.291
No	24 (14.9)	96 (59.6)	41 (25.6)	
Tobacco use (n=193)				
Yes	8 (23.5)	15 (44.1)	11 (32.4)	0.207
No	24 (!5.1)	96 (60.4)	39 (24.5)	
Oral hypoglycemic drugs (n=193)				
Yes	29 (19.1)	93 (61.2)	30 (19.7)	0.001
No	3 (7.3)	18 (43.9)	20 (48,8)	
Insulin (n=193)				
Yes	5 (5.8)	41 (47.7)	40 (46.5)	<0.001
No	27 (25.2)	70 (65.4)	10 (9.3)	
Complications (n=193)				
Yes	7 (6.9)	51 (50.5)	43 (42.6)	<0.001
No	25 (27.2)	60 (65.2)	7 (7.6)	

Statistically significant *P< 0.05.

Table 3: Association of age, BMI, Fasting blood glucose, and HbA1c with hypoglycemia score by One way ANOVA

	Hypoglycemia			P
	Unlikely	Possible	Present	
Age (year)	50.5±20.1	51.8±15.7	59.1±16.6	0.024
BMI (kg/m2)	24.0±3.9	24.9±4.6	23.4±4.7	0.120
Fasting blood glucose (mg/dl)	143.4±38.0	162.8±64.5	207.5±84.5	<0.001
HbA1c %	7.1±1.9	8.5±2.5	9.8±2.7	<0.001

Statistically significant *P< 0.05.BMI: Body mass index; HbA1c: Glycosylated haemoglobin

Table 4: Association of duration of diabetes with hypoglycemia score category (N=193)

Hypoglycemia	Duration of diabetes in years		P
	Median	IQR	
Unlikely	3.0	2.0-5.0	0.003
Possible	5.0	2.0-12.0	
Present	8.5	3.0-15.5	

*Kruskal Wallis test. Statistically significant *P< 0.05.

DISCUSSION

Hypoglycemia is an important issue with diabetes. The current study recognized 25.9% hypoglycemia patients among the study participants. The recognition of this problem will create an impact on these patients in the future management of this situation. Hypoglycemia score was higher in male participants compared to female gender.[8]

Prolonged diabetes duration was associated with a higher prevalence of hypoglycemia compared to those who had fewer duration of diabetes history. In the current study population duration of diabetes was another factor that had significant association with prevalence of hypoglycemia. The median duration of diabetes was 8.5 years for the patients with recognized symptoms of hypoglycemia. The lengthened duration of diabetes and hypoglycemia episodes proceeds in same direction towards patient's life. Similar findings have been reported by researchers.[9]

Regarding therapy, 46.5% of insulin users had higher hypoglycemia scores and among oral hypoglycemic users,19.7% subjects had hypoglycemia. Insulin treatment is effective in diabetes management though severe hypoglycemia cases are experienced frequently.[10]A cohort study reported one out of ten people with type 2 diabetes on insulin had impaired awareness of hypoglycemia and >30% with severe hypoglycemia.[11]An interview-based study among 1055 type 2 diabetics, the prevalence of all hypoglycemia was 16% with oral hypoglycemic agents and 30% with insulin.[12]

In the current study, age was another variable which was associated with hypoglycemia in diabetic participants.[13]Our study implies to the result of other studies conducted in the USA, Japan and Korea within diabetic patients that observed coalition of hypoglycemia in elder patients.[14–16] An additional potential factor alliance with the advancing age is co-morbid condition. A total of 56% hypertensive and 52.3% patients had microvascular and macrovascular complications in the study. Among hypertensives, 28.7% and 42.6% with concomitant disease suffered from hypoglycemia. Deranged lipid profile was seen in 55.4% patients and 17.1% patients with deranged LFT in the study participants which could have

ISSN (O): 2687-5365; ISSN (P): 2753-6556

contributed to it. Studies have shown that deranged lipid profile are biomarker for the microvascular and macrovascular complications.[17]

Association of higher fasting blood glucose and HbA1c with hypoglycemia was found in the study. This could be of diabetic phobia to avoid hypoglycemia episodes. Parallel to our findings other research also reported the same.[18]

CONCLUSION

Hypoglycemia was recognized by 25.9% patients according to the hypoglycemia score. There was a significant association for increasing age, longer duration of diabetes, type of treatment, presence of complications and diabetic control status with recognition of hypoglycemia. However, there was no association for gender, BMI, prevalence of hypertension and behavioral characteristics with the recognition of hypoglycemia. Longitudinal studies with larger sample sizes and longer duration of follow-up would help in understanding deeper into the awareness and management of hypoglycemia, thereby helping in formulating necessary actions for better management of the patients.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556