Reported hypoglycemia in Type 2 diabetes mellitus patients: Prevalence and practices-a hospital-based study

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**ABSTRACT**

**Introduction:** Hypoglycemia tops the list of hurdles in preventing tight glycemic control in diabetic patients. It is even considered as a cardiovascular risk factor. However, it continues to be a neglected complication with very limited epidemiological data in our country. **Aim:** To study the self-reported prevalence of hypoglycemia among type 2 diabetic patients and the practices adopted by them during and after the episodes to manage and avert future occurrences. **Materials and Methods:** It is a questionnaire-based cross-sectional study done using systematic random sampling selecting every 5\(^{th}\) patient attending the diabetic Out-Patient (OP) in a tertiary medical college hospital. **Results:** There were 366 participants with median age of 60 years. Around 96% reported any one symptom of hypoglycemia, but 78% had eaten following the episode and got relieved of the symptoms. Weakness (76.2%) and dizziness (74%) were the most common symptoms reported by the patients. A quarter of them reported having severe attacks requiring somebody’s assistance. Most patients resorted to timely meals (85%) to avert future attacks. Patients who took insulin along with oral hypoglycemic agents (OHA’s) were at a higher risk (OR = 2.3) for hypoglycemia compared to patients taking only OHA’s (\(P < 0.01\)). **Conclusion:** The reported prevalence of hypoglycemia among type 2 diabetes patients is quite high. This finding reiterates the importance of enquiring and educating every diabetic patient about hypoglycemic episodes during every health visit.

**Key words:** Hypoglycemia, practices, prevalence, severity, type 2 diabetes

**INTRODUCTION**

Strict control of diabetes is increasingly emphasized after the benefits demonstrated in the UK Prospective Diabetes Study and DCCT studies.\(^{[1,2]}\) Hypoglycemia tops the list of hurdles in preventing tight glycemic control and is often observed in patients on insulin or insulin secretagogue (like sulfonylurea) therapies. Recent studies have demonstrated that though strict glycemic control results in reduced microvascular complications, it is associated with increased cardiovascular events and even mortality (ACCORD).\(^{[3]}\) The likely explanation proposed for the latter observation is hypoglycemia and its adverse effect on the cardiovascular system through the sympathoadrenal responses. There are reports of hypoglycemia being considered as a cardiovascular risk factor.\(^{[4]}\) Hence, the American...
Diabetic Association (ADA), AACE, and other guidelines recommend not to be too strict with glycemic control, especially in the elderly or patients with long duration of diabetes and with other significant comorbidities. Similarly, the recommendations emphasize on therapies that are least prone to cause hypoglycemia. 

Further recurrent episodes of hypoglycemia result in hypoglycemia unawareness. Hypoglycemic episodes, especially if severe or recurrent may result in significant psychosocial dysfunction and lower quality of life. In spite of the knowledge about the importance of hypoglycemia, it is still a relatively neglected complication in diabetes care in our setting.

In a survey conducted among 2530 Americans with type 2 diabetes, 55% reported having experienced hypoglycemia in the past. The India Hypoglycemia Study Group highlights that there is negligible data on the epidemiology of hypoglycemia in type 2 diabetes from India, which has the second largest number of diabetes patients in the world. The ADA workgroup on hypoglycemia has reported a condition, “Probable Symptomatic Hypoglycaemia” where there are typical symptoms of hypoglycemia without a measured plasma glucose concentration. According to them, even though these conditions may not be suitable outcome measures for clinical studies evaluating therapy, it would be useful to report such episodes. Hence, we proposed to study the self-reported prevalence of hypoglycemia among type 2 diabetic patients attending the outpatient clinic in a tertiary care hospital and the practices adopted by the patients during and after the episodes to manage and avert future occurrences.

**Materials and Methods**

This was conducted as a hospital-based cross-sectional study in the diabetes clinic in a medical college hospital in Chennai, where around 70–80 patients attend OP every day. After selecting a random number between 1 and 5, every fifth patient entering the clinic was included using systematic random sampling technique. Type 2 diabetic patients who are known to have diabetes for more than 6 months were included, and those who had type 1 diabetes, gestational diabetes, and secondary diabetes were excluded from the study.

The protocol of the study was approved by the Institutional Ethics Committee. Written Informed consent was obtained from every patient included in the study. Part of the study has already been published in which the knowledge of diabetic patients on hypoglycemia has been discussed.

**Data collection procedure**

A questionnaire that sought information on the background characteristics of the patients, duration of diabetes and their current treatment, the possible symptoms of hypoglycemia, its frequency, duration, severity, possible precipitating factors, the remedial measures that patients undertake, and preventive measures followed including self-monitoring of blood glucose was prepared. The definition for compliance to medications for diabetes was taken as not having missed medications for 7 days or more.

The clinical syndrome of hypoglycemia is most convincingly documented by Whipple’s triad: Symptoms consistent with hypoglycemia, a low plasma glucose concentration, and relief of those symptoms when the plasma glucose concentration is raised. The list of common symptoms of hypoglycemia was made by wide literature search. The patients were enquired whether they had any of the listed hypoglycemic symptoms in the past 1 year. Since most of the patients did not possess a glucometer to measure plasma glucose symptoms, they were asked if they ate something immediately following those symptoms and whether they were relieved of the symptoms. If the answer was “yes” to these questions, it was considered as an episode of hypoglycemia. The episode of hypoglycemia was considered “Severe” if it required assistance of another person or hospitalization. The questionnaire was piloted with 15 patients and necessary modifications made. Information was sought from the patients through interview method. Each participant took 15–20 min to complete the interview.

**Statistical analysis**

Data entry and analysis of the variables was done using Statistical Package for Social Sciences (SPSS) version 16 (IBM Corporation, Somers, New York, USA) software. Descriptive statistics of proportion, mean, and standard deviation was calculated for the background characteristics, symptoms, frequency, duration, measures adopted, and odds ratio was calculated to find out the association of hypoglycemia with medications prescribed and duration of diabetes.

**Results**

There were 366 type 2 diabetic patients who participated in this study. Around a fifth of the patients were <50 years of age, 36% were between 51 and 60 years, and the remaining >60 years. The median age of the study population was 60 years. The majority of the patients were females (76.5%) [Table 1]. A quarter (24%) of the subjects was belonging to Class V socioeconomic status with per capita income less than INR 773, and a third (33%) was belonging to Class IV (INR 773-1546). Just 18% of
the subjects were in Class I and II (INR >2577). The mean (SD) duration of diabetes was 10.9 (5.9) years.

Any one symptom of hypoglycemia was reported by 351 (95.9%) (95% confidence interval [CI]: 93.87–97.93%) of the study subjects. The prevalence of hypoglycemic symptoms reported by the patients is given in Figure 1. Weakness (76.2%) and dizziness (74%) were the most common symptoms reported by the patients.

Most of the patients reporting hypoglycemia 307 (87.5%), gave a history of eating biscuits or chocolates or sweets or drinking tea or juice or glucose syrup or eating the meals to relieve the symptoms. Among them, 288 reported relief of symptoms shortly after eating something. Thus, 78.7% (95% CI: 74.51–82.9%) of the patients fitted in the operational definition of hypoglycemia – of having any one symptom, eating something immediately after the episode, and getting relieved of their symptoms.

Among the diabetic patients, “severe hypoglycemia” was reported by 84 (23%) patients. Among them, 69 (19%) required somebody’s assistance during the episode. Admission for hypoglycemic symptoms was reported by 29 (8%) patients of whom 9 (31%) had more than 2 admissions.

Since the most common symptoms may not always be the first to appear, the first symptom of hypoglycemia was asked separately. Dizziness “feeling gare” (in local language) was the first symptom in a third of the patients followed by sweating and excessive hunger [Figure 2].

The frequency and duration of hypoglycemic symptoms among type 2 diabetic patients are given in Figure 3. Even though half of the patients had these symptoms rarely, around 18% had frequent episodes (8% daily and 10% twice or thrice a week). These symptoms have been present for more than 5 years in 19% patients but for 31% patients, these episodes are occurring for less than a year.

Around 90.6% of the patients who had hypoglycemia (n = 318) reported the reason for symptom onset to be missing or delaying food intake and 33% (n = 117) as exertion. The preventive measures adopted by the patients for their hypoglycemic symptoms are shown in Figure 4. Taking timely meals was the measure adopted by 85% patients, 27% reported such episodes to their treating physician. Only a fifth of them regularly carried some snack item while going out.

### Table 1: Background characteristics of Type 2 diabetes mellitus patients

| Background characteristics | n  | Percentage |
|----------------------------|----|------------|
| Age in years               |    |            |
| Up to 60                   | 201| 54.9       |
| >60                        | 165| 45.1       |
| Sex                        |    |            |
| Male                       | 86 | 23.5       |
| Female                     | 280| 76.5       |
| Education                  |    |            |
| Illiterate                 | 98 | 26.8       |
| Literates                  | 268| 73.2       |
| Family type                |    |            |
| Nuclear                    | 222| 60.7       |
| Joint                      | 144| 39.3       |
| Duration of DM (years)     |    |            |
| ≤10                        | 224| 61.2       |
| >10                        | 142| 38.8       |
| Type of treatment          |    |            |
| Only OHAs                  | 291| 79.5       |
| OHAs + insulin             | 75 | 20.5       |
| Comorbidities*             |    |            |
| Hypertensives              | 320| 87.4       |
| Coronary heart disease     | 10 | 2.7        |
| Hypothyroidism             | 10 | 2.7        |
| Kidney disease             | 7  | 1.9        |
| Compliance                 |    |            |
| To OHAs (n=366)            | 322| 88         |
| To Insulin (n=75)          | 48 | 64         |

*Multiple responses collected. OHAs: Oral hypoglycemic agents, DM: Diabetes mellitus

Figure 1: Prevalence of hypoglycemic symptoms among type 2 diabetic patients

Figure 2: Prevalence of the first symptom of hypoglycemia among type 2 diabetic patients
Among the diabetic patients, 356 (97.3%) tested their blood glucose levels at a laboratory. Almost 90% of these patients tested their fasting and postprandial blood glucose levels once every 3 months, 4.4% more frequently and the rest, less frequently. Only 5 (1.4%) of the patients practiced self-monitoring with a glucometer, of which only one person tested daily.

A fifth of the patients (19%) reported that their daily routine has changed because of the hypoglycemic symptoms. Few patients, (5%) have even changed doctors due to hypoglycemic episodes.

From Table 2, it is seen that patients who are on insulin along with oral hypoglycemic agent (OHAs) are at a higher risk for hypoglycemia compared to patients taking only OHAs ($P < 0.01$). However, in this study association between duration of diabetes and occurrence of hypoglycemia was not statistically significant.

**Discussion**

This was a cross-sectional study done with the objective of finding the proportion of type 2 diabetic patients who report one or other symptom of hypoglycemia in the past 1 year and their practices with respect to hypoglycemia conducted in the diabetes OP of a medical college hospital.

Almost 96% of the study subjects reported one or other symptom of hypoglycemia. Weakness and dizziness were the most common symptoms, and dizziness, shaking, and excessive hunger were commonly the first symptom of presentation. For most of the patients (87%), the precipitating factor was missing meals followed by exertion (33%) and almost all were relieved after eating or drinking something. Hypoglycemia was severe requiring assistance in a fifth (19%) of the patients. The diabetics adopted different preventive measures, but only 1.4% did self-monitoring with a glucometer. Those taking insulin were at a higher risk for hypoglycemia compared to those taking only OHAs ($P < 0.01$).

The ADA stresses that individuals at risk for hypoglycemia should be asked about symptomatic and asymptomatic hypoglycemia at each encounter. Glucose (15–20 g) is the preferred treatment for the conscious individual with hypoglycemia, although any form of carbohydrate that contains glucose may be used. The individual should consume a meal or snack to prevent recurrence of hypoglycemia.\[10\]

In this study, severe episodes were reported by 19% and hypoglycemia requiring admissions by 8% patients. Similar results have been shown in the survey done in America where 20% of them required assistance from another party and 6% visited Emergency Departments for their hypoglycemia.\[8\]

In a German study to assess the incidence and predictors of hypoglycemia during intensification of treatment regime for type 2 diabetes patients on one or more OHAs, the documented rate of hypoglycemia was 11% in the last 12 months which increased to 14% incidence in the year of follow-up due to intensification.\[15\]
In another retrospective, a interview-based study by Miller et al. in 2001 among 1055 type 2 diabetics, the prevalence of all hypoglycemia was 16% among those taking OHAs and 30% among those taking insulin. In a prospective multicenter randomized controlled trial in 1998 in the UK among type 2 diabetics on OHAs and/or insulin, the incidence of any severity hypoglycemia was 17% among those on glyburide, 11% among those on chlorpropamide, and 36.5% among those taking insulin. That of severe hypoglycemia requiring third party assistance was 0.6%, 0.4%, and 2.3%, respectively.

**Limitations**

Self-monitoring of blood glucose by patients is very low among study subjects. Therefore, it is impossible to estimate the prevalence of hypoglycemia based on plasma glucose concentration in most clinical settings in India. Most of the symptoms of hypoglycemia are not specific and can occur in normal individuals also. These are only exaggerated in diabetic patients.

Workgroup of the ADA and the Endocrine Society has concurred that a single threshold value for plasma glucose concentration cannot be assigned to define hypoglycemia in diabetes as the glycemic thresholds for symptoms of hypoglycemia shift to lower and higher plasma glucose concentrations among those with recent antecedent hypoglycemia and in patients with poorly controlled diabetes, respectively. The cutoff value is given just to draw the attention of the patients, and caregivers to the potential harm associated with hypoglycemia. The mean duration of diabetes among the study subjects is 11 years. It is, therefore, possible that many of the patients may experience the symptoms at a higher blood glucose levels causing distress that affects the daily routine of life.

**Strength of the study**

This is one of the first studies done with the objective of finding the reported prevalence of hypoglycemia in diabetic patients. It highlights the first symptoms, frequency of severe episodes, and the practices and preventive measures adopted by patients in handling hypoglycemia.

**CONCLUSION**

It is seen from the study that the reported prevalence of hypoglycemia is very high among type 2 diabetic patients and even severe hypoglycemia requiring assistance is reported in a fifth of them, but self-monitoring of blood glucose is very low. It is high time that doctors treating diabetic patients start enquiring about hypoglycemic symptoms during every health visit as well as educate on preventive measures which are followed by only fifth of the patients.

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**Conflicts of interest**

There are no conflicts of interest.

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