Original Article

**Occurrence Of Hypoglycemia In Hospitalized Diabetic Patient Referred To Endocrine Department Of Sir Ganga Ram Hospital, New Delhi**

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key words:

Hypoglycemia in diabetic

OHA

Abstract

**Introduction**: Diabetes mellitus results from relative deficiency or reduced effectiveness of endogenous insulin leading to both micro-vascular and macro-vascular complications. Treatment goal is intensive therapy as early as possible in patients with both Type-1 or type-2 diabetes to bring the HbA1c <7. Occurrence of hypoglycemia in a diabetic patient is a common side effect of treatment. This study aimed to find out causes Hypoglycemia in diabetics.

**Methods**: It was prospective analysis of admitted diabetes patient with other co-morbid conditions who were on either OHA or Insulin.

**Results:** Out of 36 diabetics 7 of them t had severe hypoglycemia, 22 had moderate and had mild hypo most of them had CKD, other organ dysfunction.

**Conclusion**: Hypoglycemia can occur despite cautious treatment protocol especially in diabetic with organ dysfunction.

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**Introduction:**

Diabetes mellitus results from lack/reduced effectiveness insulin and intensive therapy with HbA1c goal should be <7%. DCCT and the

Stockholm Diabetes Intervention Study (SDIS) showed that intensive therapy reduced the incidence/progression of micro-vascular complications in patients with type-1 diabetes.[1,2]

UKPDS and the Kumamoto study determined that stricter glycemic control could be useful in delaying the onset and progression of diabetic micro-vascular/macro-vascular complications as well in patients with type-2 diabetes[3,4] Current insulin secretagogues or conventional subcutaneous insulin delivery system cannot replace the physiology of *B*-cell. The risk of hypoglycemia increases with absolute/relative insulin excess/ compromised glucose regulation.[5] In earlier stages of type-2 diabetes when glucose counter-regulatory responses are still functional, hypoglycemia is less common than in type-1 diabetic patients. Since progressive B-cell failure is a key pathophysiological feature of type-2 diabetes, the characteristics of disease and frequency of hypoglycemic episodes eventually approach that of type-1 diabetes.[6] .

Hypoglycemia begets hypoglycemia[7] and overtime worsens to severe hypoglycemia, nocturnal hypoglycemia and arrhythmia.[8] Occurrence of hypoglycemia is associated with potentially serious physical and psychological consequences.

This study aimed to find out the iteology of hypoglycemia in admitted patient and to prepare the team for early recognition and prompt management of Hypoglycemia at SGRH.

**2.METHODS:**

**2.1.Study site**: This study was conducted in patient admitted in Sir Ganga Ram Hospital (SGRH) with other medical conditions along with uncontrolled Diabetes who were consulted endocrine department for control of sugar. SGRH is a Super-specialty /Tertiary Care Teaching Hospital situated at Old Rajinder Nagar in the heart of Delhi which caters to all categories of population in terms of their socioeconomic condition.

**2.2.Study duration**: The study was conducted on inpatient between 2014 and 2015.

**2.3.Study design**: It was a Cross-sectional observational study

**2.4.Sample-size**:Being prospective observational study, all consecutive patients meeting the eligibility criteria during the study period were included(36).

**2.5. Inclusion criteria:**

* All the patient of Diabetes Mellitus both Type-1 and Type-2
* Diabetes on Insulin or OHAs.
* Adult and older aged Patients admitted in Sir GangaRam Hospital.

**2.6. Exclusion criteria:**

* Children and adults > 95years of age
* Diabetic on diet/medical nutrition therapy (MNT).
* Gestational DM

**2.7.Methodology:** This is a Hospital based observational case study carried out on various patients admitted at Sir GangaRam Hospital ,Old Rajinder Nagar New Delhi, India, involving the sample Size –36 case of uncontrolled Diabetes with various medical and surgical ailments requiring admission and intervention.. Its known fact that this hospital caters patients from various parts and all aspects of life as patients from every socioeconomic status can seek treatment in this hospital. Amongst the patients with DM with hyperglycemia/ hypoglycemia were included after taking informed consent.

Thorough evaluation was done including detailed history, physical examination and necessary laboratory investigations of all enrolled patients. Demographic variables included age, sex, marital status and occupation of the patients. History of OHA/Insulin, intake of food and last dose of drugs timing was taken into special consideration to rule out obvious precipitating cause. Past history of hypoglycemia and awareness of “hypo” symptoms and treatment history was taken with emphasize to awareness of hypoglycemia in such patients as it is recommended by ADA Guideline for management of hypoglycemia that all the patients at risk for hypoglycemia should be asked about symptomatic and asymptomatic hypoglycemia at each encounter.

Detailed clinical examination was done. Vital sign and other signs like pallor, icterus, sweating and altered sensorium were documented. Anthropometric measurements including height, weights were taken and BMI was calculated. All the blood samples were collected by the nursing staff at the time of clinical/incidental hypoglycemia using Glucometer further confirmed by biochemistry Department of Sir Ganga Ram Hospital. Routine and specific laboratory tests were carried out immediately after collection of sample using standard laboratory protocol.

Staff on duty took few drop of blood out from the finger pulp after wiping it with spirit swab by using sterile disposable surgical blade and BGM was recorded by using Glucometer at bedside when patient was found to be symptomatic hypoglycemic as noticed by the patient/patient party. Next venous blood samples was taken in separate vial and sent to laboratory for blood glucose level.

\*CBC comprising TC, DC, Hemoglobin, Haematocrit, Platelets, and ESR was done during admission for any cause.

\*LFT, KFT, Relevant culture for microorganism, was sent as per need.

\* HbA1C, C-peptide and S.Insulin Level were advised during hypoglycemic episode in those patient whose BGL <60mg/dl.

Therapy was adjusted to meet the following glucose targets on individual basis:

- RBS >70-100mg/dL (3.8-5.5 mmol/L) within 15 min. of treatment of hypoglycemia either by giving carbohydrate-rich sugar (glucose powder),juice or IV Dextrose rapidly depending upon cognitive state.

-1Hr Post-dextrose RBS >100 mg/dL (5.5 mmol/L)

-Target glucose level between 140-180mg/dl (7.7-10.0 mmol/L).

 The goal of treatment is to prevent recurrence of hypoglycemia thus target glycemia was kept slightly higher than normal so as the sympathetic awareness is reversed from unawareness of hypoglycemic symptoms. Dietary modifications were considered to avoid peaks in blood sugar levels by spreading carbohydrate intake over meals and snacks throughout the day, and using more fiber in foods with whole grains, or fruit and vegetables. If monitoring revealed poor control of glucose levels with these measures, treatment with insulin might become necessary but individually optimized cautiously to avoid hypoglycemia.

**Statistical Analysis:**

Statistical data was analyzed using SPSS Version 17.0. Continuous variables were presented as Mean, SD, or Median for non normally distributed data. Categorical variables were expressed as frequencies and percentage. Odd ratio and95% CI will also be calculated to find the odds of various factors in cases as compared to normoglycemic patients. p value ,0.05 will be taken to indicate a significant difference.

**3.RESULT:**

Out of the 36 Patients analyzed, 24 were male and 12 were female (M/F=2; 1) ranging from 35 to 91 years of age. Majority of them were <65yrs (N=20) rest (16) were >65 years of age.

Distribution of patient according to Age group:

|  |  |  |  |
| --- | --- | --- | --- |
| Age between 30-40 | Age between 50-60 | Age between 70-80 | Age between 80-90 |
| 5 | 23 | 6 | 2 |

Most of them were admitted with poor sugar control along with other co-morbid conditions. Following were there baseline HbA1c on admission. Mean HbA1c was 8.4.

|  |  |  |  |
| --- | --- | --- | --- |
| HbA1c up to 6  Well controlled | HbA1c(6-8) Fairly controlled | HbA1c(8-10)  Poorly controlled | HbA1c>11  Uncontrolled |
| 3 | 13 | 14 | 6 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mean HbA1c | HBA1C <7(5-6) | Between 7-9(7-8) | >9(9-10) | >11 |
| **8.4** | 5.0 | 7.0 | 9.1 | 11.0 |
|  | 5.7 | 7.0 | 9.1 | 11.1 |
|  | 5.8 | 7.1 | 9.3 | 11.1 |
|  | 6.6 | 7.6 | 9.4 | 11.2 |
|  | 6.7 | 8.0 | 9.4 | 11.3 |
|  | 6.7 | 8.1 | 9.6 | 11.4 |
|  | 6.7 | 8.1 | 10.3 |  |
|  | 6.8 | 8.2 | 10.6 |  |
|  | 6.9 | 8.2 |  |  |
|  |  | 8.2 |  |  |
|  |  | 8.4 |  |  |
|  |  | 8.6 |  |  |
|  |  | 8.6 |  |  |

Besides uncontrolled sugar for which they were referred to us ,17 of them had deranged renal function due to long standing DM while 4 had deranged LFT due to ALD/CLD.7 Patient had Triopathy 3 with LVF while 4 had acute CAD along with CKD and Retinopathy. 10 of them were admitted with various infections 1-Meningoencephalitis, 2 Cholecystitis, 3 Urosepsis, 2COAD and 1 Pulmonary Aspergilloma.

Hypoglycemia was mild in 13, moderate in 19 and severe in 6 documented patient. 1 patient remained unconscious for 1 hr.2 patient went to hypo repeatedly 30-60 minute later and they were liver failure patient awaiting liver-transplant. 15 patient had BGL>100mg after 15min while 21 patient had BGL >100mg after 30min.

Glucometer reading during Hypo episodes.

|  |  |  |  |
| --- | --- | --- | --- |
| Severe  [20-40]mg | Moderate  [40-60]mg | Mild  [60]mg | Mild [70]mg |
| 23/24 | 45 | 61 | 70 |
| 22/25 | 47 | 62 | 74 |
| 25 | 50 X8Pt | 64x3pt |  |
| 31 | 52 | 65 |  |
| 38 | 54 X3Pt | 66 |  |
| 38 | 56 X3Pt | 67 |  |
|  | 60 XPt | 68 |  |

Insulin dose mismatch with carbohydrate was found in 13 patients. Insulin dose overlap in 10 patients.3 patients didn’t eat after taking insulin prior meal. History of severe hypo was found in 5 patient.8 patients were transferred to OT, Dialysis, ICU/ Cath Lab, CT/MRI Scan, and from Other hospital after Insulin injection without food intake.7 patient took OHA without carbohydrate and self medication even after admission.21 patient had reduced intake of carbohydrate after Insulin or OHA due to other illness. 10 of them had new NPO Status.30 patient were suffering from critical/ chronic-illness(CKD,CAD,CVD,DF Infection) .4 patient had effect of GA . 4 Patient had hormonal deficiency [hypothyroidism in 3 and post pancreatectomy in 1 pt]. 2 patients of liver and renal transplant had sudden reduced steroid dose. Drug dispensing error was noted in 5 patient out of them 1patient received reduced dose of steroid but previous dose Insulin, 1 pt got Insulin infusion continued despite BGL<150, 1patient took short acting Insulin but dint take dinner due to nausea and vomiting, 1patient took insulin but left the breakfast and one patient received basal insulin as per our advice and overlapped short-acting insulin advised by Doctor on call at Emergency.

**4.DISCUSSION:**

Diabetes mellitus results from lack or reduced effectiveness of endogenous insulin which results into hyperglycemia and metabolic derangements which further leads to both micro vascular and macro vascular complications. The real world poses a significant problem though and the numbers are far from satisfactory. [[2]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=161;epage=162;aulast=Patell#ref2) Hypoglycemia, and the fear and potentially disastrous consequences that follow, is well recognized in patients with Type 1 diabetes; its importance in Type 2 diabetes mellitus (DM) is often underestimated and less well appreciated [[3]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=161;epage=162;aulast=Patell#ref3),[[4]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=161;epage=162;aulast=Patell#ref4). Although therapy is initiated to control hyperglycemia by use of Insulin or OHAs, current insulin secretagogues or conventional subcutaneous insulin delivery system cannot replace the physiology of *B*-cell so occurrence of hypoglycemia in a diabetic patient is a common side effect of treatment that is most feared by patient. Hypoglycemia is an unpleasant experience associated with potentially serious physical and psychological consequences .It’s a fatal condition that worries not only the patient and their relative but also to the treating physician/team. Doctor, Nurse and health care team should be vigilant in detecting, treating and preventing hypoglycemia while treating diabetic patient. Certain oral hypoglycemic agents SU Sulpphonylurease (glyburide and metformin) are considered nasty in hypoglycemic patient and significantly dangerous to the developing neuroglycopenia especially in serious Patient with critical illness and organ dysfunction. 

Recent Indian studies show that only 20.4% of diabetes care physicians set HbA1c of <7% as target for their patients [[9]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref4) and only 19.7% of patients achieve this value. [[10]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref5) This clinical inertia has often been attributed to presence or fear of hypoglycemia, both among physicians and patients. [[11]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref6) It can thus limit the aggressive -ness of drug therapy, decrease adherence to diet and reduce patients' willingness to take medications as directed. [[12]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref7) Hypoglycemic symptoms may also lead to increased calorie intake and worsening of glycemic control.

According to ADA Guideline for management of hypoglycemia all the patients at risk for hypoglycemia should be asked about symptomatic and asymptomatic hypoglycemia at each encounter.[13]

According to Canadian diabetic study, they have found from a Retrospective studies have suggested a link between frequent severe hypoglycemia (≥5 episodes since diagnosis) and a decrease in intellectual performance. These changes were small but, depending on an individual’s occupation, could be clinically meaningful. Prospective studies in type 1 diabetes have not found an association between intensive insulin therapy and cognitive function [[14-16]](http://guidelines.diabetes.ca/Browse/Chapter14#bib10). A meta-analysis concluded that lowered cognitive performance in people with type 1 DM appeared to be associated with the presence of micro vascular complications but not with the occurrence of severe hypoglycemic episodes or with poor metabolic control [[]7]](http://guidelines.diabetes.ca/Browse/Chapter14#bib13).

Association between frequency of hypoglycemia and glycemic control has been consistently reported in the past. Hypoglycemia episodes were observed more frequently in intensive therapy arms of large studies like UKPDS, ACCORD, ADVANCE, and VADT. [[](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra#ref1)[[18]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref20),[[19]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref21),[[20]](http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2014;volume=60;issue=2;spage=151;epage=155;aulast=Kalra" \l "ref22)

Hypoglycemia is characterized by “Whipple triad”

1. Documentation of low blood sugar,

2. Presence of symptoms, and

3. Reversal of these symptoms when the blood glucose level is restored to normal.

**Definition of Hypoglycemia in Diabetes: ADA Guidelines**

Iatrogenic hypoglycemia in patients with diabetes : Abnormally low plasma glucose concentration that exposes the patient to potential harm

Glycemic thresholds for symptoms of hypoglycemia can shift.As such, a single threshold value for plasma glucose that defines hypoglycemia in diabetes cannot be assigned. Patients taking Sulfonylurea, Glinide, or Insulin are at risk for hypoglycemia .Alert these patients to risk when plasma glucose ≤70 mg/dL (≤3.9 mmol/L)

**Classification of Hypoglycemia in Diabetes:**

Alert value for hypoglycemia :≤70 mg/dL (≤3.9 mmol/L) plasma concentration

- Severe hypoglycemia: Requires assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions . Plasma glucose conc. may not be available during an event .Neurological recovery following plasma glucose levels returning to normal considered sufficient evidence that event was induced by low plasma glucose concentration

-Documented symptomatic hypoglycemia : Typical hypoglycemia symptoms accompanied by measured plasma glucose ≤70 mg/dL (≤3.9 mmol/L)

-Asymptomatic hypoglycemia : Not accompanied by typical hypoglycemia symptoms but with measured plasma glucose ≤70 mg/dL (≤3.9 mmol/L)

-Probable symptomatic hypoglycemia: Typical hypoglycemia symptoms not accompanied by plasma glucose determination but likely caused by plasma glucose ≤70 mg/dL (≤3.9 mmol/L)

-Pseudo-hypoglycemia: Reports of typical hypoglycemia symptoms with measured plasma glucose >70 mg/dL (>3.9 mmol/L) but approaching that threshold.

**5. CONCLUSION:**

Management of Diabetes requires understanding the progressive nature and stage of this disease.Various co-morbid condition play role in altering the pattern of regular treatment.In hospital attention to avoid hypoglycemia should be the aim that can be achieved through coordination between the treating team and on duty staff so as to avoid drug dispensing error, Insulin /OHA dose and timing, mismatch between carbohydrate, Reducing Prolonged NPO by giving priority to operate diabetic at the beginning and raising awareness among the staff involved in the care of patient. At times there is mismatch in Insulin therapy with the proportion of carbohydrate intake due to poor oral intake after insulin administration or due to vomiting, transfer to OT, Hemodialysis, Endoscopy unit, USG etc.

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