e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(10); 17-22

Original Research Article

Clinical Profile of Patients Admitted in ICU Having Admission Hyperglycemia

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Received: 25-07-2023 / Revised: 28-08-2023 / Accepted: 30-09-2023
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Conflict of interest: Nil

Abstract:

Background: Hyperglycemia is regarded as a significant risk factor that affects patient morbidity and death. Any type or cause of elevated blood sugar can have negative clinical effects on patient outcomes, mortality, impatient complications, length of stay, and total hospital costs. The Objective of the study was to find out prevalence, cause of admission hyperglycemia and to estimate relationship between hyperglycaemia and short term disease outcome.

Methods: Randomly selected 50 hyperglycemia cases whose random blood sugar were above 180 mg/d1 and were admitted under the intensive medical care unit were selected in period of 18 months. Detailed demographic recording and risk factor evaluation along with clinical investigations were done. Blood sugar and HbAlc was done in all the patients.

Result: Out of 50 patients, 30 were males and 20 were females. Admission hyperg1ycemia.were present in 21 diabetic patients, 17 latent diabetics and in 12, it was due to Stress hyperglycemia. Mean age of the study group patients was 51.76 + 16.09 SD. 35(70%) patients were below 60 years. Different diseases were involved in the study like 23(46%) had cardiac condition, 10(20%) had stroke, 9(18%) had infections, 1(2%) had respiratory condition, 1(2%) had cardio respiratory condition, 1(2%) had cardiac condition with infection and 5 (10%) miscellaneous condition.

Conclusion: Critically ill patient may have Admission hyperglycemia due to diabetes and also due to nondiabetes conditions. Elevation of blood sugar level may be because of stress hyperglycemia which needs appropriate treatment. Admission hyperglycemia is very commonly associated with cardiac conditions, stroke and infections. Frequent monitoring of blood sugar should be done in all critically ill patients whether they are diabetic or non-diabetics.

Keywords: ICU, Hyperglycemia, Morbidity, Mortality, Diabetics, Non-diabetics.

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Introduction

Recent developments in the medical industry have prompted efforts to pinpoint risk variables that are crucial in connection to prognosis. Additionally connected to morbidity and death are these risk variables. One such risk factor is hyperglycemia. [1,2]

Diabetes mellitus may lead to hyperglycemia. However, it can happen as a result of stress hormones in crucial situations as well as in illness states, and is referred to as "Stress Hyperglycemia". Other names for this syndrome include "New onset Hyperglycemia", "In hospital Hyperglycemia", "Admission Hyperglycemia", "New Hyperglycemia", and "reactive Hyperglycemia". The severity of an illness is related to hyperglycemia. Diabetes or not, hyperglycemia is regarded as a personal risk factor for death and morbidity. This is valid for a variety of illnesses for which patients may be admitted to hospital wards or critical care wards. This is accurate in both medical and surgical situations, when postoperative hyperglycemia is a recognized disease. This happens in patients who have been hospitalised for acute abdominal disorders, sepsis, cerebrovascular accidents, acute myocardial infarction, and other illnesses.

One of the key findings is that insulin should also be used to treat hyperglycemia in people who are not diabetic. This idea gave rise to the idea of intensive insulin treatment for diabetes. It was shown that reducing hyperglycemia improved the course of illness. [3,4]

Even though several research are conducted, it is unclear what blood sugar level should be achieved for the best results. The patient may die from hypoglycemia, although strict control of hyperglycemia may enhance results because of blood sugar levels. There is disagreement over the degree of hyperglycemia that requires treatment and the lowest level at which it should be reduced so that a beneficial outcome may be achieved. [5,6]

This study is related to hyperglycemia in patients who were admitted in critical care wards of our institution. The Objective of the study was to find out prevalence, cause of admission hyperglycemia and to estimate relationship between hyperglycaemia and short term disease outcome.

Materials and Methods

This cross sectional, prospective, observational study was carried out at ICU; Dhiraj General Hospital affiliated to Shrimati Bhikibai Kanjibhai Shah Medical Institute, Piparia Village, Waghodia in Vadodara, Gujarat. Our ICU is well equipped, spacious 17 bedded units. Medical wards have 240 bed capacities. Daily 3-4 patients are admitted in ICU, 3-4 in ICCU and 25-30 in Medical wards. Hospital runs Diabetic clinic once a week on Friday. It is embedded with 240 beds in Medicine department with 17 beds in ICU. This study included 50 patients which lasted from 1/3/2014 to 1/9/2015.

Each patient, or their families in situations of related altered state of consciousness, was asked for a thorough clinical history describing the method of start, course, and final outcome.

Particularly taken into account as an individual risk factor for changed clinical outcomes in certain individuals is history of Diabetes Mellitus, Hypertension, prior cardiovascular event, and immunological condition. Additionally, a comprehensive search was conducted among the individuals whose high blood glucose levels had just been discovered. Their follow-up sugar and glycosylated hemoglobin were performed to determine the reason of hyperglycemia. Every patient got a thorough general examination with a focus on their vital signs. To assess the level of clinical morbidity, a thorough systemic examination was also completed. Their performance at various glycemic levels was evaluated. Patients who had admission hyperglycaemia (RBS > 180mg%), search has been made to find out cause of increased blood sugar, mainly 2 groups formed.

Study Sample: Randomly selected hyperglycemia cases admitted under the intensive medical care unit, Most of the patients were admitted during my posting in ICU or who came under our unit team's care. 50 such cases were selected.

Selection of patients: All patients having admission hyperglycemia with or without co-morbid conditions were included in our study. Hyperglycaemia means RBS= or >180 mg/dl. The patients who did not give past history of diabetes, "Admission Hyperglycemia" was confirmed with one or more subsequent results in first 24 hours and RBS readings were equal or more than 180 mg/d1.

Inclusion criteria: Admission Hyperglycemia including RBS on admission and HbA1c.

Exclusion criteria

- Gestational diabetes and hyperglycemia in pregnant women.
- Patients who is given IV glucose before admission or is given drugs which can elevate Blood sugar.
- Patients having acute diabetic emergency like Diabetic Ketoacidosis, Hyperosmolar non-ketotic coma and others.
- Non consenting patients.

Statistical Analysis

The data was collected, coded and recorded on Microsoft Excel Spread sheet program and descriptive statistical analysis was performed. All the results were expressed as mean ± SD. Normality for continuous data was checked using Shapiro-Wilk Test. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) software (version 23). Statistical significance was kept at $p<0.05$.

Results

Total 50 patients of Admission Hyperglycemia were studied.

Table 1: Age distribution in patients of admission hyperglycemia

Age Group (Years)	Total	%
<30	5	10
30-40	9	18
40-50	6	12
50-60	15	30
60-70	11	22
70-80	2	4
80-90	2	4
Total	50	100

Table 1**,** the maximum number of patients (26 out of 50) were in the range of 50-70 years. Thus problem of admission hyperglycemia were of the age group between 50 to 70 years (52%). The maximum male patients were in the range of 50-60 years and minimum patients were in the range of 70-90 years. The maximum female patients were in the range of 30-40 and 40-50 years and minimum patients were in the range of 80-90 years.

Table 2: Admission hyperglycemia mean age

Obs	Mean	Var	Std Dev	Min	Median	Max	Mode
50	51.7600	259.0433	16.0948	16.0000	54.5000	90.0000	40.0000

Table 2**,** Mean age was 51.76 + 16.09 SD in the study group patients. Minimum age was 16 years who was female and maximum age was 90 years who was also female. Out of 50 patients, 2l had admission hyperglycemia due to diabetes. 29 had new onset hyperglycemia of which 17 were latent diabetics and 12 had Stress hyperglycemia.

Table 3: Type of admission hyperglycemia gender distribution (N=50)

Type	No.	Male	Female
Diabetic	21	11(52.38%)	10(47.62%)
Latent	17	12(70.59%)	05(29.41%)
Stress (SHG)	12	07(58.33%)	05(41.66%)
Total	50	30	20

Out of 2l diabetic hyperglycaemic patients, 11 were male and 10 were female. (52% Vs 47%), of 17 latent diabetic group patients, 12 were male and 05 female, showing male dominance. In SHG group of 12 patients, 7 were male and 2 were female. Of 30 male patients 11, 12 and 07 were in diabetic, latent diabetics and Stress hyperglycaemic group respectively. **Table 3** suggests Male and Female domination in latent diabetic group patients.

Table 4: Type of admission hyperglycemia-age distribution (n=50)

Age Group	Diabetic (n=21 patients)				Latent (n=17 patients)				Stress (SHG) (n=12 patients)				
(Yrs)	M	%	F	%	M	%	F	%	M	%	F	%	Total
0-30	0	0	0	0	1	2	0	0	3	6	1	2	5(10%)
31-40	1	2	3	6	1	2	1	2	1	2	2	4	9(18%)
41-50	2	4	1	2	2	4	3	6	0	0	1	2	9(18%)
51-60	4	8	2	4	3	6	0	0	2	4	1	2	12(24%)
>60	4	8	4	8	5	10	1	2	1	2	0	0	15(30%)
Total	11	22	10	20	12	24	5	10	7	14	5	10	50

As shown in above **Table 4**, out of 50 patients 30 were males of which 11 had admission hyperglycemia due to diabetes. Of these 11, 4 were in geriatric group and 7 were below 60 years of age. Of 10 female patients from diabetic hyperglycemia group, 4 were in geriatric group and 6 were below 60 years of age. Of 12 male latent diabetic hyperglycemia groups, 5 were in geriatric group and 7 were below 60 years of age. Of 5 female latent diabetic hyperglycemia groups, l was in geriatric group and 4 were below 60 years of age. Of 7 male SHG patients, 1 male and no female were in geriatric group while 6 male and 5 were below 60 years of age.

Table 5: Total and gender wise distribution of disease conditions for which patients were admitted and had admission hyperglycemia

Condition	Male	Female	Total
Reason for ICU admission			
Infection	7	2	9(18%)
Cardiac	14	9	23(46%)
Stroke	5	5	10(20%)
Respiratory	1	0	1(2%)
C,R	1	0	1(2%)
C,I	0	1	1(2%)
M	2	3	5(10%)
Total	30	20	50(100%)

Table 5**,** of 50 patients, 9 patients had infections, 23 were admitted for cardiac conditions, 10 for stroke, 1 for respiratory conditions, 1 for cardiorespiratory, 1 with cardiac combined with infections and 5 with miscellaneous conditions.

18% patients whose diabetes was detected after admission were patients of cardiac diseases.

Majority (8 out of 9) were male patients. 32 patients had hospital stay below 10 days, 11 had between 11 to 20 days and 7 had between 21 to 30 days. Mean hospital stay was higher in male patients in comparison to females.

New onset hyperglycemia group (Latent+SHG) had more hospital stay than known diabetic patient.

Table 6: RBS level (MG/DL) on admission

	Sex	N	Mean	Std. Deviation	t-value	p-value
Diabetic	M	11	333.91	81.571	2.498	0.022
	F	10	252.80	65.323		
Latent	M	12	261.50	76.747	-0.347	0.733
	F	5	277.80	114.014		
Stress	M	7	241.00	85.446	-0.212	0.837
	F	5	250.60	63.457		

Table 6 shows level of hyperglycemia in selected patients. 11 patients (22%) had RBS between 180 to 200. Of 11, known diabetic was 5, SHG was in 3 and 3 patient had new onset Diabetes/latent diabetes. Higher RBS was observed in known diabetic group patient. One patient of SHG had sugar level between 351-400 and another had between 401-450. They had normal sugar level on discharge.

Table 7: Glycosylated hemoglobin

Inference	Sex	N	Mean Gly Hb	Std. Dev.	p-value
Diabetic	M	11	10.03	2.684	0.982
	F	10	10.05	1.863	
SHG	M	7	4.77	.547	0.100
	F	5	4.10	.742	
Latent	M	12	6.27	.347	0.643
	F	5	6.38	.335	

Table 7, Diabetic male patients had mean HbAlC of around 10.03 & 2.684 while female had 10.05 & 1.863. SHG group patients had normal HbAlC. Latent diabetic group had HbAlC of 6.27 & 0.347 and 6.38 & 0.335 respectively.

Discussion

50 patients who were admitted to the ICU during the course of 18 months, from March 3, 2014, to January 9, 2015, were included in the research. Every patient underwent RBS and those with >180 mg/dl had their HbA1c levels looked at. According to their needs, the patients received insulin using a traditional regimen. The glucometer used the prick technique to measure the sugars.

Three types of patients who had hyperglycemia upon admission were established. Stress hyperglycemia (SHG) is a term used to describe a group of individuals who were previously normoglycemic, first became hyperglycemic, and then showed signs of returning to normal sugar levels after a few days. Patients who have increased blood sugar levels since being admitted, particularly as a result of other conditions including a stroke, myocardial infarction, sepsis, asthma, or trauma, are considered to be long-term patients. One recent study highlighted the fact that patients with hyperglycemia are more likely to have increased mortality and morbidity. This finding also applies to people with hyperglycemia who are not diabetic. This investigation was conducted because we wanted to test this fact in our setting. Studies on admission hyperglycemia have shown that this condition is a separate risk factor. When adjusting for age, gender, and Injury Severity Score in various logistic regression models, Yendamuri et al, discovered that admission hyperglycemia in truma patients was an independent predictor of greater infectious morbidity.

In this study, 52% of the participants were between the ages of 50 and 70. This might be a reflection of the type 2 DM age group. 42% of the individuals in this research with hyperglycemia were known to have diabetes. 56.6 of the 30 male patients fell into this age category. The study group patients' average age was 51.76 and 16.09 SD. Owing to the inclusion of patients with new onset hyperglycemia, which includes patients with stress hyperglycemia and latent diabetic patients who become overt owing to illness circumstances, this average age is lower than that of diabetic group patients as a whole. [7]

The cohort of admission hyperglycemia patients investigated by Gebreegziabher Yohannes et al, had a mean age of 63+0.87 years and a mean BMI of 29.3. [8]

Several studies on reviewing the literature on several disorders that cause hyperglycemia, there are chapters 11 to 18 available. These studies were conducted to examine the clinical outcomes in stress hyperglycemic patients with various clinical conditions, such as stroke, MI, sepsis, surgery, etc. These issues might exist in known diabetics. [9-13]

Whether the patients had diabetes or not, a research by Capes SE, Hant D, et al. showed that stress hyperglycemia also increased the chance of mortality following myocardial infarction. According to research, a significant portion of non-diabetic individuals who experience an acute myocardial infarction have glycosuria, and up to half of these patients also have hyperglycemia. Additionally, there is evidence between hyperglycemia during an AMI and death. There is a 3.93 relative risk of death in hospitals. Patients without diabetes or stress hyperglycemia had a relative risk of 1.71% in comparison. [14]

Additionally, McOwen KC et al. demonstrated that stress hyperglycemia is frequent and probably linked to at least some of the complications of diabetes mellitus hyperglycemia, including slower wound healing and a greater infection risk. The primary reason is the severe counter regulation of the cytokine response to critical disease, which is frequently exacerbated by the injection of an excessive amount of dextrose. [15]

In our study, 10 out of 50 individuals (20%) experienced a stroke. Acute myocardial infarction and stroke are two frequent diseases associated with stress hyperglycemia that have been studied extensively in connection to disease outcomes. Diabetes, undiagnosed diabetes, and those with high blood sugar levels all increase the risk of stroke. In our study, out of 10 patients, 5 (50%) had diabetes, the other 4 had latent diabetes, and the remaining patient had new-onset hyperglycemia. [16] The majority of research also show that stroke patients' outcomes are worsened by high blood glucose levels, whether they are caused by diabetes or stress hyperglycemia. According to Rady MY et al., the death rate for stroke patients with stress hyperglycemia but no known diabetes increased by thrice. [17]

18% of the 50 patients, or 9 individuals, had infections and entry hyperglycemia. The third-largest group was this one. Admission hyperglycemia was seen in 3 diabetic hyperglycemic patients, 2 latent diabetic individuals, and 4 SHG patients. Most patients were in the SHG group. [18]

The authors of the study "Admission Hyperglycemia and Length of Hospital Stay in Patients with Diabetes and Heart Failure: A Prospective Cohort Study" by Gebreegziabher Y et al., discovered a connection between glycemia and length of hospital stay (LOS). 212 individuals with an abrupt HF exacerbation had diabetes in 56% of them. Patients with diabetes had substantially longer LOS than those without diabetes (5.0 + 0.29 vs 3.4 + 0.19; P.001). [8]

According to current concept for Intensive diabetes management, goal should be HbA1C% - 5.6-6.5, pre-prandia1 glucose - <126mg/d1, bedtime glucose — 100- 140mg/d1 and FBS 110mg/dl. However, further work in this sphere is needed for deciding level of sugar which will benefit the most of without risk of hypoglycaemia. [19,20]

In our study as mentioned early target blood sugar value was 120-180 mg/d1 which probably may be considered high, however these level of glycaemic control is accepted by various guidelines and by many critical care specialists.

Conclusion

Stress hyperglycemia (SHG), which may be a brief increase in blood sugar, is a common occurrence in intensive care units and was present in 24% of the entry hyperglycemia group. At younger ages, admission hyperglycemia occurs. Patients in the study group had a mean age of 51.76 + 16.09 SD. Only 30% of patients were in the geriatric category (those over 60), with 70% of patients being under 60. Most cases of stress hyperglycemia occurred in people under the age of 60. 50% of the individuals with hyperglycemia at admission had underlying cardiovascular diseases. Cardiovascular diseases frequently involve insulin resistance and stress hyperglycemia.

Hyperglycemia may be linked to other problems including stroke and infections in critically unwell individuals. 10% of patients had other illnesses (other than cardiovascular, stroke, and infections) that required ICU hospitalization. An extended hospital stay might be impacted by hyperglycemia. HbAlC is crucial in determining the type of hyperglycemia. Treatment for individuals with hyperglycemia of both diabetes and non-diabetic origin that achieves a goal blood sugar of 180 or less by intravenous insulin is appropriate. Monitoring blood sugar is crucial for identifying and treating hyperglycemia in intensive care units set up.

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