Incidental Hyperglycemia and Detection of Diabetes in Patients Presenting to the Emergency Department of a Tertiary Care Hospital

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ABSTRACT

Introduction: Nearly half of people with diabetes don't know they have it. It is often not diagnosed until complications appear. The aim of the study was to determine the prevalence of diabetes mellitus and prediabetes in patients presenting to the Emergency Department with incidental hyperglycemia, because the duration of hyperglycemia is a predictor of adverse outcomes, and there are effective interventions to prevent disease progression and to reduce complications.

Methods: It was an observational cross-sectional study, 720 patients from Emergency Department of Kathmandu Medical College, Sinamangal were screened from December 2018 to March 2019 and a total of 128 patients with incidental hyperglycemia (>140mg/dl) were included. Patients with a previous diagnosis of diabetes, unstable patients and pregnant patients were excluded. Incidental hyperglycemia, fasting blood sugar, 2 hours postprandial blood sugar and HbA1c were noted, data entry was done in Microsoft Excel and analysis was done using the SPSS 24.

Results: Total of 128 patients were enrolled for the study.10% of the patients had hyperglycemia and 34% among the hyperglycemic had the finding in the absence of history of diabetes. Incidental hyperglycemia ranged from 150-500 mg/dl. Among the incidental hyperglycemic, 29% and 36% had prediabetes and diabetes respectively. Incidental hyperglycemia was divided into four groups; <159, 160-179, 180-199 and >200 mg/dl, and each group was analyzed with the diagnostic criteria and the final outcome. It was found that each group correlated well with the diagnostic criteria and final outcome and was found to be statistically significant with p<0.0001 based on the Chi square test.

Conclusions: Following the patients with incidental hyperglycemia in the Emergency Department, a significant number of undiagnosed diabetes or prediabetes can be diagnosed, early intervention can be started that can prevent progression from prediabetes to diabetes and risk of complications can be reduced.

Keywords: incidental hyperglycemia; emergency department; diabetes; prediabetes.

INTRODUCTION

Many individuals without access to primary care have risk factors for diabetes and present to the Emergency Department (ED) seeking care for unrelated complaints and illnesses.[1] Hyperglycemia is a common finding in the ED patients, but its occurrence is not restricted to patients with known diabetes. It is also regularly found in patients with either previously undiagnosed diabetes or transient metabolic disturbance in response to severe illness, commonly referred to as stress hyperglycemia.[2,3] The ED provides medical care to a unique population that has limited access to screening and preventive interventions and thus, wider adoption of

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screening initiatives in the ED may improve the health of this vulnerable population.[4] In addition, the ED offers a high potential of encountering patients with diabetes risk factors, including elders, obese patients and high-risk racial and ethnic minorities.[5]

The main aim of the study was to determine the prevalence of diabetes mellitus and pre-diabetes in ED patients with an elevated random blood glucose.

METHODS

Observational cross-sectional study was conducted among 128 patients with incidental hyperglycemia. 720 patients from Emergency Department of Kathmandu Medical College, Sinamangal were screened from December 2018 to March 2019 and a total of 128 patients with incidental hyperglycemia (>140mg/dl) were included. Written informed consent was taken from the participants before being enrolled.

Study population were the patients 18 years and above presenting to the emergency department of Kathmandu Medical College, Sinamangal. Convenience method of sampling was used, and all the hyperglycemic patients presenting to the emergency department from December 1st 2018 to 31st March 2019 was taken as sample.

- **Inclusion criteria:** Patients 18 years or above, random blood sugar > 140 mg/dl

- **Exclusion criteria:** Previously diagnosed diabetes mellitus, Pregnant patients, Patients with a severe acute illness with unstable vital signs defined as hypotension (systolic blood pressure < 90 mm Hg), tachycardia (heart rate of > 120 beats∕min), tachypnea (respiratory rate of > 30∕min), or hypoxemia (pulse oximetry of < 90% on room air or required a non-re-breather face mask) or if they were admitted to an intensive care unit.

Study variables included age, sex, random blood sugar, diagnosis of diabetes. Semi-structured Performa was used as the tool for data collection.

Diagnostic Criteria

The following diagnostic criteria was used for the diagnosis of prediabetes or diabetes:

|	Prediabetes	Diabetes
Fasting Blood Sugar mg/dl	100-125 mg/dl	≥126 mg/dl
2hrs Post Prandial Blood Sugar mg/dl	140-199 mg/dl	≥200 mg/dl
HbA1c %	5.7 – 6.4%	≥6.5%

Fasting Blood Sugar was taken after overnight fasting of 8hrs

- 2 hrs Post Prandial Blood Sugar was taken after 2 hours of regular meal

- Diagnosis required at least two abnormal test results

All the data recorded in the Performa were entered in Microsoft Excel. SPSS version 24 was used for data analysis. Both descriptive and analytic statistics was used. Chi square test was used for the statistical analysis of the data.

RESULTS

From December 2018 to March 2019, a total of 720 patients presented to the emergency of Kathmandu Medical College, Sinamangal with hyperglycemia, 480 were previously known diabetic, and 240 of them had incidental hyperglycemia. Figure 1 shows the flow diagram of subjects. Of the 240, 85 lost to follow up, 15 were with unstable vital signs and 12 were pregnant. A total of 128 patients were included for the analysis. Baseline data were recorded, fasting, 2 hours post prandial and HbA1c was sent and patients were advised to follow up with reports to the General Practice OPD. 37 were found to have diabetes, 46 prediabetes and 45 had normal results.
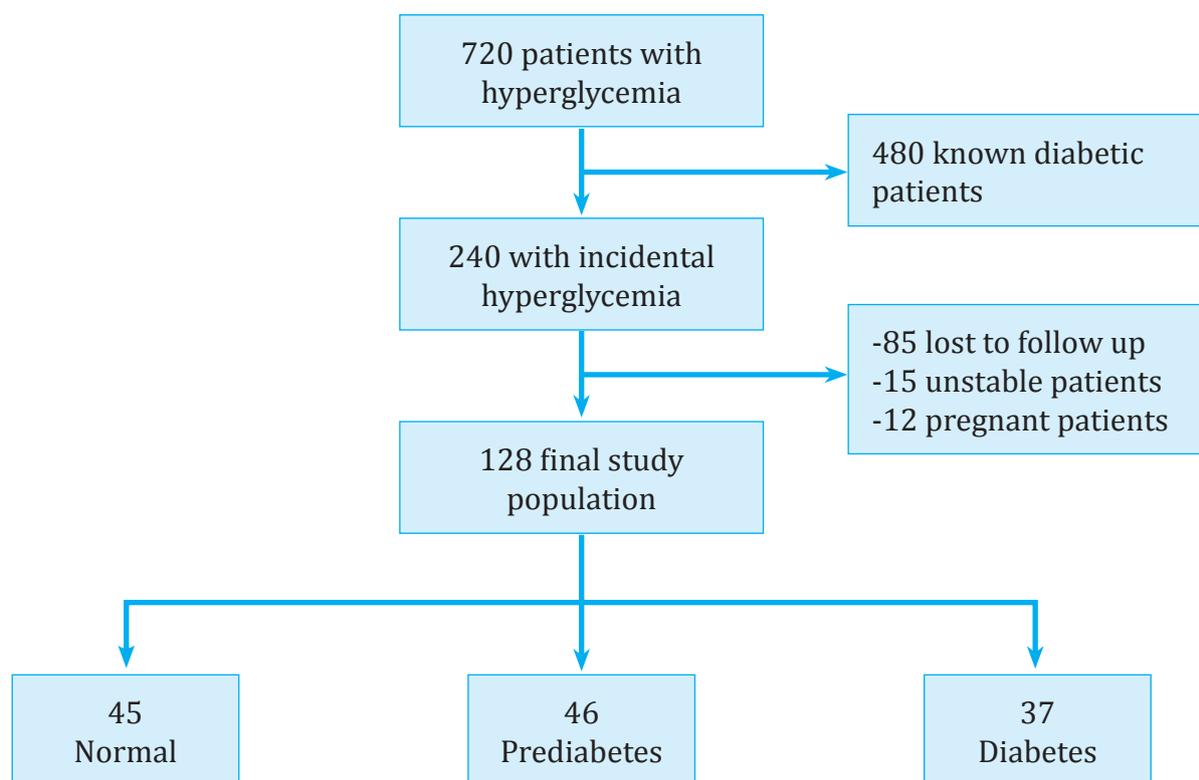
Figure 1. Flow Diagram of patients

The baseline characteristics of the subjects. The average age was found to be higher in diabetic group compared to normal or prediabetic group. The sex distribution was almost equal in all the three groups.

Table 1. Baseline Characteristics

Characteristics	Normal	Prediabetes	Diabetes
Number (%)	45(35%)	46(36%)	37(29%)
Age (years mean ± SD)	39.98 ±11.87	48.43 ±12.00	57.46 ±13.23
Sex (M/F)	24/21	23/23	19/18
RBS (mg/dl mean ± SD)	150.76 ±6.99	186.52 ±18.16	327.95 ±109.78
FBS (mg/dl mean ± SD)	92.82 ±5.42	121.00 ±10.85	195.22 ±62.08
2 hrs PPBS (mg/dl mean ± SD)	136.20 ±8.49	185.87 ±28.86	324.51 ±105.69
HbA1c (% mean ± SD	5.47 ±0.14	6.07 ±0.4	7.87 ±1.26
n = 128			

SD: Standard Deviation, RBS: Random Blood Sugar, FBS: Fasting Blood Sugar, PPBS: Post Prandial Blood Sugar, HbA1c- Glycosylated Hemoglobin

The following pie chart shows the male female distribution. 52% of subjects were male.
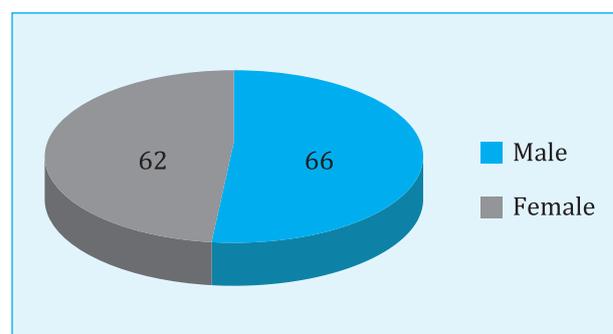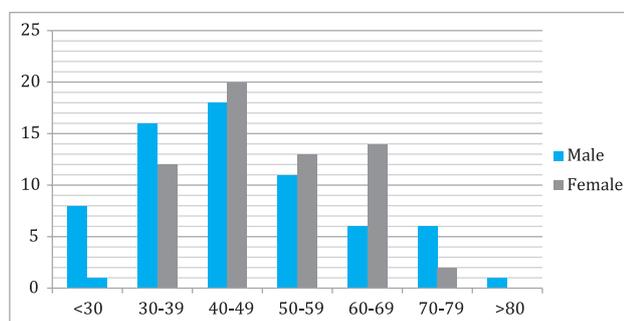

Figure 2. Sex Distribution

On analyzing the age group and outcomes, around 30% of subjects were in between 40-49 years. We found that incidental hyperglycemia in subjects who were older than 50 years was associated with either diabetes or prediabetes. Table 2 shows the relationship between the age group and outcomes.

Table 2. Relationship between age group and outcome

Age Group	Normal	Prediabetes	Diabetes	Total
<30	8 (89%)	1 (11%)	0	9
30-39	13 (46.4%)	11 (39.3%)	4 (14.3%)	28
40-49	15 (39.5%)	15 (39.5%)	8 (21%)	38
50-59	6 (25%)	11 (45.8%)	7 (29.2%)	24
60-69	3 (15%)	5 (25%)	12 (60%)	20
70-79	0	3 (37.5%)	5 (62.5%)	8
>80	0	0	1 (100%)	1
n = 128				

The following bar diagram shows the age group and sex relationship.

Figure 3. Age group and sex distribution

The incidental hyperglycemia was further divided in 4 sub groups for analysis; <159 mg/dl, 160-179 mg/dl, 180-199 mg/dl and >200 mg/dl. The sub groups were then analyzed with the final outcome and each of the variables from the diagnostic criteria. Table 3 shows the relationship between subgroups and fasting blood sugar.

Table 3. Relationship between subgroup and FBS (fasting blood sugar)

Group/ FBS	<100mg/dl	100-125mg/dl	≥ 126mg/dl	Total
<159	42 (93.4%)	2 (4.4%)	1 (2.2%)	45
160-179	3 (14.2%)	17 (81%)	1 (4.8%)	21
180-199	2 (13.3%)	12 (80%)	1 (6.7%)	15
>200	1 (2.1%)	13 (27.6%)	33 (70.3%)	47
p < 0.0001				
n = 128				

The following table 4, 5 and 6 shows the relationship between the sub groups and Post Prandial Blood Sugar, HbA1c and outcomes respectively.

Table 4. Relationship between subgroup and PPBS (2hrs Post Prandial Blood Sugar)

Group/ PPBS	<140mg/dl	140-199mg/dl	≥ 200mg/dl	Total
<159	41 (91.1%)	4 (8.9%)	0	45
160-179	3 (14.2%)	16 (76.2%)	2 (9.6%)	21
180-199	0	14 (93.4%)	1 (6.6%)	15
>200	0	15 (32%)	32 (68%)	47
p < 0.0001				
n = 128				

Table 5. Relationship between subgroup and HbA1c

Group/ HbA1c	<5.7%	5.7-6.4%	≥ 6.5%	Total
<159	42 (93.4%)	3 (6.6%)	0	45
160-179	6 (28.5%)	12 (57.2%)	3 (14,3%)	21
180-199	1 (6.7%)	13 (86.6%)	1 (6.7%)	15
>200	2 (4.2%)	11 (23.4%)	34 (72.4%)	47
p < 0.0001				
n = 128				

Table 6. Relationship between subgroup and outcomes

Group/ Outcome	Normal	Prediabetes	Diabetes	Total
<159	42 (93.4%)	3 (6.6%)	0	45
160-179	3 (14.3%)	16 (76.2%)	2 (9.5%)	21
180-199	0	14 (93.4%)	1 (6.6%)	15
>200	0	13 (27.6%)	34 (72.4%)	47
p < 0.0001				
n = 128				

DISCUSSION

Diabetes mellitus is occurring in epidemic proportions and is clearly a major

national and international health problem, which must be addressed.[1] This was an observational cross-sectional study carried out among the 128 patients presenting with incidental hyperglycemia to the emergency of Kathmandu Medical College, Sinamangal from December 2018 to March 2019, total of 4 months duration. Known diabetic, incidental hyperglycemia in pregnant and patients with unstable vital sign were excluded from the study.

The average patient flow per day during the data collection period was 60, among them 10% had hyperglycemia. This finding is similar to the study conducted by Prince et al in 2005.[6] 34% among the hyperglycemic had the finding of hyperglycemia in the absence of a history of diabetes. Upon following the incidental hyperglycemic patients, 29% had diabetes and 36% had prediabetes. This frequency of diabetes and prediabetes in the emergency department population may be an important finding, because a large proportion of population visits the emergency department yearly and identifying and following the incidental hyperglycemic patients may aid in the early diagnosis, delaying the progression and prevent the complications of diabetes mellitus.

The outcome subjects were divided into normal, prediabetes and diabetes group. Incidental hyperglycemia in the young age group was found to be normal subjects. The average age in the prediabetic and diabetic was 48 and 57 years respectively. The sex distribution among the three groups was almost the same. The incidental hyperglycemia ranged from 140 to 500 mg/dl. Average incidental hyperglycemia in the normal, prediabetic and diabetic group was 150, 186 and 327 mg/dl respectively.

75 – 100% patients older than 50 years with incidental hyperglycemia had either diabetes or prediabetes. We can assume that not all the incidental hyperglycemia in older age group are due to acute stress, we need to follow them to rule out the chances of being diabetic or prediabetic. The subgroup analysis of the incidental hyperglycemia was done and Chi Square test with a p value of < 0.1 was used. Incidental hyperglycemia correlated well with each of the variables of diagnostic criteria and the final outcome with a p value of <0.0001. We found that higher the level of incidental hyperglycemia, higher is the chance of being diabetic or prediabetic. More than 90% with incidental hyperglycemia of <150 mg/dl had normal results whereas 100% with incidental hyperglycemia of >180 mg/dl had either diabetes or prediabetes.

In the discussion of the implication of these findings, it is important to acknowledge the established fact that acute stress results in a physiologic elevation of glucose.[6] However, the findings from the study conducted by Silverman et al showed a significant correlation between hyperglycemia and HbA1c levels among the non-diabetic patients in the emergency department, suggesting that emergency hyperglycemia indicates undiagnosed diabetes.[7] Similarly Ginde et al estimated the risk for undiagnosed diabetes in emergency patients using ADA risk score and found that 33% were at high risk for undiagnosed diabetes and 42% had elevated risk.[8]

This study emphasizes the importance of screening for the high risk individuals and patients with incidental hyperglycemia from the Emergency Department to identify undiagnosed diabetes and to start with interventions that can prevent progression from prediabetes to diabetes and reduce the risk of complications.

CONCLUSIONS

A substantial percentage (10%) of our emergency department patients had

hyperglycemia and 34% among them had hyperglycemia in the absence of diagnosed diabetes or prediabetes, thus at risk for undiagnosed diabetes and prediabetes. Upon following the incidental hyperglycemia, a significant percentage (65%) of them had either undiagnosed diabetes or prediabetes. Following the incidental hyperglycemia from the emergency department provides the opportunity to identify undiagnosed diabetes or prediabetes and to start with the interventions that can prevent progression from prediabetes to diabetes and reduce the risk of complications. Further multi-centered studies with large cohort and longer follow up of the patients may be needed. Further studies with longer follow up including the acutely ill and pregnant patients with Emergency Department blood sugar values and other known diabetes risk factors and strict ADA/WHO criteria for the diagnosis may be needed.

CONFLICT OF INTEREST: None

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