Frequency of Hyperosmolar Hyperglycemic State in type 2 Diabetic Patients

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ABSTRACT

Background: Hyperosmolar hyperglycemic syndrome is a clinical condition that arises from a complication of diabetes mellitus, and seen in type 2 diabetes mellitus.

Objective: To determine the frequency of hyperosmolar hyperglycemic state in type 2 diabetes mellitus patients.

Study Design: DescriptiveCross Sectional study.

Place and Duration of the Study: Department of Medicine, Hayatabad Medical Complex, Peshawar; from January 2020 to March 2020.

Methodology: A total of n=156patients with type 2 diabetes mellitus (as per operational definitions) taking treatment with controlled DM aged 35–75 years of either gender were included. Pregnant females and CRF were excluded. After this, each patient was evaluated by the researcher herself for presence or absence of hyperosmolar

hyperglycemic state.

Results: Age range in this study was from 35 to 75 years with mean age of 50.71 ± 9.25 years. Majority of the patients (73.08%) were between 35 to 55 years of age. Out of these 156 patients, 69.90% were male and 39.10% were females. The mean duration of diabetes mellitus was 7.78 ± 3.08 years, and body mass index was 30.18 ± 3.40 kg/m2. The frequency of hyperosmolar hyperglycemic state in type 2 diabetic patients was found among 11.54% of type 2 diabetic patients.

Conclusions: It was concluded that hyperosmolar hyperglycemic state in type 2 diabetes mellitus showed moderate prevalence and showed relationship with age, gender, socio-economic status, obesity, and duration of type 2 diabetes mellitus.

Keywords: Diabetes Mellitus, Hyperosmolar Hyperglycemic State, Gender, Body Mass Index

INTRODUCTION

Globally, there are 415 million people with diabetes and the death toll of diabetes hit 5 million in 2015; moreover, the diabetes population is expected to rise to 642 million by 2040[1]. Hyperosmolar hyperglycemic state is a life-threatening emergency manifested by marked elevation of blood glucose and hyperosmolarity with little or no ketosis[2]. Diabetes mellitus is a globally prevalent systemic metabolic disease which is the fifth most common cause of death worldwide[3]. Type 2 diabetic patients may account for as much as one-third of all DKA cases[4]. Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic states (HHS) are the two most commonhyperglycemic emergencies (HEs) associated with diabetes mellitus. Individuals with HEs can present with combinedfeatures of DKA and HHS[5]. Many previous studies have reported that some patients with HEs could have combined features of HHS and DKA[6, 7]. Diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS) are hyperglycemic emergencies that continue to account for increased burden of hospitalizations in both developed and developing countries [8, 9].

In the USA, Kitabchi et al. used a varietyof low-dose insulin regimens, e.g., 0.22 units per kilogram(with a subsequent sliding scale dependent on subsequentglucose concentrations) or 0.33 units per kilogram followedby an infusion of 7 units per hour[10, 11]. These regimensled to a steady reduction in glucose and Ketone concentrationsat a rate comparable to the higher insulin doses[12, 13]. Hyperglycemic hyperosmolar state and diabetic ketoacidosis are life-threatening events for diabetes patients[14]. Diabetes mellitus (DM) is a major public health problem whose rates have risen dramatically[15].Hyperglycemic hyperosmolar state occurs mostly in adults and elderly patients and has ahigher mortality than DKA with death occurring in 5–16%[16, 17].

The hyperglycemic hyperosmolar state & diabetic ketoacidosis are two serious, preventable complications ofdiabetes mellitus. Analysis of variables associated with recurrent DKAand HHS admission has the potential to improve patient outcomes byidentifying possible areas for intervention (18). Poor adherence to diabetes medication causes 21% of HHS cases[19].

Acute complications of diabetes include hypoglycemia, diabetic ketoacidosis (DKA), and hyperglycemic hyperosmolar syndrome. The most severe acute metabolic complications of diabetes mellitus are DKA and Hyperosmolar Hyperglycemic State[20]. This clinical condition was formerly called non-ketotic hyperglycemic coma; hyperosmolar hyperglycemic non-ketotic syndrome, and hyperosmolar non-ketotic coma (HONK)[21, 22].In a study, conducted in 2019, and published by Bedasoet a., showed that 9.0% of type 2 diabetes mellitus had hyperosmolar hyperglycemic state[23].

Pakistan is a developing country and has high prevalence of non-communicable diseases. The complications and morbidity of diabetes mellitus is increasing and thus cross sectional study was conducted to determine the frequency of hyperosmolar hyperglycemic state in type 2 diabetic patientsand highlight its relationship with age, gender, socio-economic status, BMI, insulin therapy, life style, and illiteracy so to reduce the complications and to effectively manage the type 2 diabetes mellitus.

METHODOLOGY

After taking ethical approval, a descriptive cross-sectional study was conducted by the Department of Medicine, Hayatabad Medical Complex, Peshawar; from January 2020 to March 2020. In which a total of n=156 patients with type 2 diabetes mellitus taking treatment with controlled DM aged 35–75 years of both gender, with diabetes more than two years,were included via non probability consecutive technique. Those DM patients who are pregnant and or having complications of diabetes mellitus were excluded. After this, each patient was evaluated by the researcher for presence or absence of hyperosmolar hyperglycemic state. The sample size was 156 as determined by WHO calculator by taking 95% confidence level, 4.5% margin of error and taking percentage of hyperosmolar hyperglycemic state in type 2 diabetic patients as 9.0%.[7]

After approval from local ethical review committee, 156 patients presenting to the OPD of Department of Medicine, Hayatabad Medical Complex, Peshawar, fulfilling the Inclusion criteria were selected. Informed, written consent was taken from each patient. After this, each patient was evaluated by the researcher herself for presence or absence of hyperosmolar hyperglycemic state (as per-operational definition). All this data (age, gender, BMI, duration of DM, taking treatment (oral hypoglycemic/insulin), place of living, monthly income (<20000/20000-40000/>40000), lifestyle (simple/sedentary) and hyperosmolar hyperglycemic state (present/absent)) was recorded on a predesigned proforma (Annexure-I).

Statistical analysis was performed using SPSS version 25.0. Age, height, weight, BMI and duration of DM were presented as mean and standard deviation. Gender, taking treatment (oral hypoglycemic/insulin), monthly income (<20000/20000-40000/>40000), lifestyle (simple/sedentary), education (illiterate/primary/middle/matric/graduate) place of living and hyperosmolar hyperglycemic state (present/absent) were presented as frequency and percentage. Stratification was done for age, gender, BMI, duration of DM,

taking treatment (oral hypoglycemic/insulin, monthly income (<20000/ 20000-40000/ >40000), lifestyle (simple/sedentary), education (illiterate/primary/middle/matric/graduate) and place of living. Post-stratification chi square test was applied to see their effects on the frequency of hyperosmolar hyperglycemic state and p value ≤ 0.05 was considered as significant.

RESULTS

The age range of the study participants n=156 was from 35 to 75 years (50.71 ± 9.25). Out of n=156 patients, 95 (69.90%) were male and 61 (39.10%) were females. The mean duration of diabetes mellitus was 7.78 ± 3.08 years, and mean BMI was 30.18 ± 3.40 kg/m2.

Table 1.Distribution of patients according to age groups, gender, duration of DM, BMI, type of treatment, place of living, lifestyle, monthly income & education status of patients (n=156)

Variables	Frequency (%)
Age in years	
35-55	114 (73.08)
56-75	42 (26.92)
Gender	
Male	95 (60.90)
Female	61 (39.10)
Duration of diabetes	
≤5 years	35 (22.44)
>5 years	121 (77.56)
BMI	
≤24	48 (30.77)
>24	108 (69.23)
Taking Treatment	
Oral hypoglycemic	108 (29.23)
Insulin	48 (30.77)
Place of Living	
Rural	68 (43.59)
Urban	88 (56.41)
Monthly Income	
≤20000	28 (17.95)

20001-40000	67 (42.95)
>40000	61 (39.10)
Lifestyle	
Sedentary	113 (72.44)
Simple	43 (27.56)
Education Status	
Illiterate	26 (16.67)
Primary	17 (10.9)
Middle	36 (23.08)
Matric	28 (17.95)
Graduate	49 (31.41)

Table Stratification of hyperosmolar hyperglycemic state with respect to age groups, gender, duration of DM, BMI, type of treatment, place of living, lifestyle, monthly income & education status of patients (n=156)

Variable	Hyperosmolar Hyperglycemic State		
Age groups	Yes	No	P-value
35-55	12	102	0.514
56-75	6	36	
Gender			
Male	12	83	0.594
Female	6	55	
Duration of DM			
≤5 years	3	32	0.533
>5 years	15	106	
BMI			
≤25	7	71	
≥25	11	67	0.316
Taking treatment			
Oral hypoglycemic	8	100	0.015
Insulin	10	38	
Place of living			
Rural	8	60	0.938
Urban	10	78	

Lifestyle			
Sedentary	8	100	0.015
Simple	10	38	
Monthly income			
≤20000	5	23	0.311
20001-40000	5	62	
>40000	8	53	
Education			
Illiterate	2	24	0.266
Primary	1	16	
Middle	7	29	
Matric	1	27	
Graduate	7	42	

DISCUSSION

According to our study results, n=42 patients has above 55 years, as was revealed in an international study showing association of hyperosmolar hyperglycemic state with old age, and thus our study supported the findings of the previous studies [24].In our study, n=18 (11.54%) patients has hyperosmolar hyperglycemic state as was found in a study conducted by Klingensmith et al, in 2016 showed 2% prevalence among the type 2 diabetes mellitus, thus our study prevalence was more as compared to international study which revealed only 2% prevalence of hyperosmolar hyperglycemic state among diabetic patients [25]. Moreover in an international study [25], it was found that 46.8% of type 2 diabetic patients has hyperosmolar hyperglycemic state and thus our study populations had less prevalence as compared to study of Klingensmith et al., and high prevalence as compared to 2020 study of Wu XY et al [5, 25].

Hyperosmolar hyperglycemic state is a serious lethal state of hyperglycemia with different degrees of conscious disturbances, ranging from lethargy tocoma, which differs from DKA. HHS is the most dangerous complication of T2DM and was reported to be between 10–40% [26, 27]. Our study findings support this study finding with 11.54%.Many international studies revealed strong association of advanced age, male gender, high glucose, and altered mental status were associated withhyperosmolar hyperglycemic state as was supported and revealed by our study results [28, 29].

Our study results showed strong relationship of overweight and obesity with hyperosmolar hyperglycemic state and revealed 50.0% prevalence. The risk factors for hyperosmolar

hyperglycemic state includes overweight, morbid obesity, long-term steroid use, and a family history of diabetes, as were revealed and showed strong significant association with type 2 diabetes mellitus having hyperosmolar hyperglycemic state[30, 31]. Thus our study support the findings of previous results, with significant chi square test value of 0.316 (Table 2).

In adults, insulin should be started with an initial intravenous bolus of 0.1 units per kg, followed by a continuous infusion of 0.1 units per kg per hour until the blood glucose level falls to 250 to 300 mg per dL (13.9 to 16.7 mmol per L)[32]. According to our study results, 30.77% of the diabetic patients were using insulin for management of type 2 diabetes mellitus and thus supported previous findings of Wu XY et al., 2020, published in BMC Endocrine Disorders, which showed 10.8% compliance to insulin [5]. Moreover, our study also supported the findings of previous international studies of Hirsch & Emmett, 2020; Wolfsdorf et al., 2018; &DhatariyaKetan, 2017; with taking or using insulin for diabetes management and treatment [10-12].

There is insufficient data on the epidemiology of hyperosmolar hyperglycemic state, and previous studies reported approximately 1% of all hospital cases with history of type 2 diabetes[33, 34]. Moreover the hyperosmolar hyperglycemic state cases are seen in patients in the fourth & fifth decades of life and were strongly supported by our study results [34, 35]. In the developed countries, due to increase rate of obesity, there is increase incidence of type 2 diabetes and HHS among diabetic patients, and according to our study results, 50% were overweight/obese among the reported cases [34, 35]. According to our study results, 60.90% of the patients were male, as was reported by an international study of Wu XYet a., 2020, showing 44.9% of diabetic patients with presentation of hyperosmolar hyperglycemic state cases [5]. Moreover, in another international study, 49% showed prevalence among male individuals and thus our study findings supported the previous research findings [5, 18].

According to our study results, 77.56% of the patients had duration of diabetes more than 10 years as was reported by an international study showing 24.1% of diabetic patients with duration of more than 10 years, thus our study population duration of diabetes was more as compared to previous study of Wu XY et a., 2020 published in BMC Endocrine Disorders[5]. Our study results showed that 69.28% had sedentary life style as was reported by a study conducted in 2020 by Tittelet. al., which showed that 89.1% had positive sedentary life style history [24]. Moreover, in our study 56.41% were urban residents as was revealed by a study showed strong association of hyperosmolar hyperglycemic state among diabetic patients with urban residence [36].

CONCLUSION

It was concluded that the frequency of hyperosmolar hyperglycemic state in type 2 diabetes mellitus was high, and showed relationship with age, gender, socio-economic status, obesity, and type of treatment for type 2 diabetes mellitus. Thus proper screening and management of hyperosmolar hyperglycemic states among the type 2 diabetic

patients is of utmost importance to effectively manage diabetes and to reduce the complications among the individuals.

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