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Original Research Article

Role of HbA1c and duration of diabetes in predicting mortality in patients of diabetic ketoacidosis in type II diabetes mellitus

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ABSTRACT

Background: Previous studies have reported the presence of diabetes ketoacidosis in patients of type 2 diabetes mellitus (T2DM). India reported that up to 30% of hospitalized DKA cases result in inpatient death. Aims and objectives of the study was to study the role of HbA1c and duration of diabetes in outcome of patients of diabetic ketoacidosis in type 2 diabetes mellitus.
Methods: Hundred T2DM patients having DKA admitted in the Department of Medicine, Gandhi Medical College and Hamidia Hospital, Bhopal, were included. Data on demography (age, sex and diabetes duration, random blood sugar (RBS) and glycated hemoglobin (HbA1c) were recorded for each patients. Outcome was also recorded and compared with duration of diabetes and HbA1c level.
Results: DKA was more common in age group of51-55 years (21%) with mean age of 56.10±10.40 years. Male preponderance was observed. Mean duration of diabetes, hemoglobin, random blood sugar (RBS) and HbA1c were 7.28±3.81 years, 9.8±1.42 gm%, 351.72±22.32 mg/dl, and 7.14±0.10 respectively. Mortality was higher among the patients with longer duration of diabetes (23.1%; p=0.012) and higher HbA1c (25%, p>0.05).
Conclusions: Duration of diabetes play a significant role in deciding mortality in T2DM patients with DKA however HbA1c has no role in that.

Keywords: Diabetic ketoacidosis, Mortality, Prognostic factor, Type 2 diabetes mellitus

INTRODUCTION

As per the recent report of International Diabetes Federation (IDF) type 2 diabetes mellitus (T2DM) has affected more than 400 million people and it is expected to affect more than 640 million people by 2040.[1] Increase in age and obesity will result in doubling of the T2DM prevalence in next 20 years.[2] This will also lead to an increase in life threatening diabetes related complications including cardiovascular disease, end-stage renal disease (ESRD), retinopathy and neuropathy.[3]

Diabetic ketoacidosis (DKA) is a hall mark for the type 1 diabetes mellitus patients, however in last two decades several studies have documented the presence of DKA in T2DM patients. A retrospective study studying the DKA patients found that 47% had known type 1 diabetes, 26% had known type 2 diabetes and 27% had newly diagnosed diabetes.[4,5]

HbA1c has become the test of choice for measuring hyperglycemia and it also correlates well with diabetes related chronic complications. A previous report studying

11092 non diabetic subjects reported a strong association of HbA1c with risk of cardiovascular disease and mortality.6 Every 1% increase in HbA1c is associated with 30% increase in all-cause mortality.[7]

In diabetes patient DKA is the culprit for the rise in hospitalization in both developed and developing countries. However, the cause for this increase in hospitalization for DKA is still not known.[8,9] In present study we tried to evaluate the causes of hospitalization for DKA and whether HbA1c level and diabetes duration in T2DM patients has any relation with higher admission for DKA.

METHODS

A prospective observational study was performed on 100 T2DM patients who presented with DKA and were admitted at Department of Medicine, Gandhi Medical College and Hamidia Hospital, Bhopal, Madhya Pradesh, India.

All patients of T2DM with DKA who had onset of diabetes mellitus after 25 years of age were included in the study. Patients of Type 1 diabetes mellitus with DKA, patients with hyperosmolar state and hyperglycemia without ketoacidosis, pregnancy, alcohol abuse and chronic kidney disease with serum creatinine>3 mg/dl were excluded from the present study.

Information was collected through preapproved proforma for each patient and informed consent was obtained from each patients. The study protocol was approved by Institutional Ethics Committee of Gandhi Medical College, Bhopal.

Data on patient's demography, characteristics of the diabetes, urine dipstick quantification of glycemia, glycosuria, and ketonuria, vital signs, biochemical profile and events and treatments during the first 24 hour after admission were recorded.

Data concerning clearance of ketonuria was evaluated at 6-hour intervals with use of reagent strips (graded with 0-5 plus signs). Follow up of all the patients was done till discharge or death.

The diagnosis of DKA was made in the emergency department by the presence of 4 laboratory findings; a plasma glucose level of 250 mg/dl or higher, a serum bicarbonate level of 15mEq/L or lower, an arterial blood pH of 7.35 or lower and presence of urinary ketones with Dipstick.

Intravenous Insulin was administered according to the standard institutional treatment algorithm. Additional hydration and electrolyte replacement were left to the discretion of the treating physicians, although American Diabetes Association (ADA) practice guidelines were followed. The insulin infusion was discontinued 2 hours after the administration of subcutaneous insulin once patients had resolution of their metabolic status,including a ketone-free urine sample,and were able to tolerate oral feedings.

All patients were investigated with complete hemogram, urine analysis, plasma glucose(mg/dl) and HbA1c. ECG was done before administration of potassium.

Data was entered in M.S. excel 2010. Data was presented in the form of frequency and percentage and wherever required appropriate statistical test of significance was applied. Data was analyzed using IBM SPSS ver. 20 software.

RESULTS

Mean age of patients with DKA was 56.10±10.40 years with male preponderance. Majority of the patients were in the age groups of 51-55 years (21%).

Majority of the DKA patients had diabetes duration of 6-10 years (56%) hemoglobin between 8-10 gm% (47%), RBS between 351-400 mg/dl (43%) and HbA1c between 8.6-10%. Mean duration of diabetes, Hb, RBS and HbA1c were 7.28±3.81 years, 9.8±1.42 gm%, 351.72±22.32 mg/dl, and 7.14±0.10 respectively.

Table 1: Association of different parameters with clinical outcome in study cohort.

Parameters		Outcome		Total	P value
		Died	Survived		
Duration of DM (DD) (years)	≤10	4 (5)	76 (95)	80	0.012
	>10	3 (23.1)	10 (76.9)	13	
HbA1c (%)	6.5-10	4 (4.9)	77 (95.1)	81	NS
	>10	3 (25)	9 (75)	12	

Data is expressed as number of patients (percentage), DD; diabetes duration, HbA1c; glycated hemoglobin, NS; not significant, p Value of <0.05 is considered as significant

DISCUSSION

DKA is a life-threatening acute condition with a mortality rate up to 5%.[10] It is characterized by the presence of ketonemia and ketonuria and acidemia.[11]

In the present study we studied the mortality and its prognostic factors associated with T2DM patients presenting with DKA. We found 21% mortality in present study cohort among the DKA patients. Previous study by Gibb et al of DKA admission reported lower mortality rates after 4.9 years of follow up.[12]

In present study we found that longer duration of diabetes was a significant predictor of mortality among T2DM DKA patients. Though insignificant, patient with HbA1c

>6.5% had higher mortality. In a multivariate analysis by Kruljac et al, reported higher number of DKA admission; longer duration of diabetes and older age were the independent factors for mortality, which is in agreement to present study findings.[13] Sreekumar et al, studied 55 diabetes patients and found a strong positive correlation between duration of diabetes and mortality among the DKA patients which is in agreement to present study findings where patients having diabetes duration of >10 years had shown high mortality (p=0.012).[14] This observation is consistent with study by Elmehdawi RR et al.[15] Similar to present study findings Gibb et al studied 164 DKA patients and reported that HbA1c has no role in mortality (p=0.220) however author has found longer diabetes duration among the deceased patients as compared to those who were alive (p=0.004).[12] However, T1DM Exchange Clinic Registry also confirmed progressive increase in DKA with increasing HbA1c levels. Previous reports have also documented that a young T2DM patients having longer duration of diabetes does not increase the DKA presentations.[16]

Present study had few limitations. Cross sectional nature was the main one, due to that present study finding cannot be applied to larger population; small sample size was the second one; a large randomized clinical trial is required to strengthen the present study findings.

CONCLUSION

Mortality due to DKA in T2DM is high. Duration of diabetes play a significant role in deciding mortality in T2DM patients with DKA. However, we did not find any relation with HbA1c level of T2DM patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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