

Original Research Article

Clinical profile of diabetic ketoacidosis in type 2 diabetes patients at a tertiary care centre

Hardik More^{1*}, Dilip Patil², Chahat Singh³

¹Department of Cardiology, Government Medical College and Superspecialty Hospital, Nagpur, Maharashtra, India

²Department of Medicine, ACPM Medical College, Dhule, Maharashtra, India

³ACPM Medical College, Dhule, Maharashtra, India

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*Correspondence:

Dr. Hardik More,

E-mail: drhardikmore@rediffmail.com

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ABSTRACT

Background: The present study was undertaken to analyse the clinical profile of type 2 diabetes patients presenting with diabetic ketoacidosis at the time of presentation, owing to dearth of scientific enquiry into this research query.

Methods: The present study was an analytical, cross-sectional study conducted over the period of two years. All the type 2 diabetes patients with diabetic ketoacidosis admitted during the study period constituted the study population, after being subjected to prefixed selection criteria. Detailed clinical history was recorded and thorough physical examination was conducted of all the participants, along with basic relevant blood parameters.

Results: Out of the total 60 type 2 DM patients with DKA studied, 53.3% patients belonged to 51 to 60 years age group and 55% were males. All the patients had fruity breath odour at the presentation. Obesity was present in 48.3% and Kussmaul breathing observed in 90% of patients. Poor compliance to treatment (51.7%) was the biggest precipitating factor of DKA in type 2 DM patients. Around 2/3rd (68.3%) was on oral hypoglycemic agents (OHA), 10% were on OHA and insulin, while 21.7% were newly diagnosed at the time of presentation. Mean RBS in type 2 DM patients with DKA was 510.8±153.5 mg/dl and mean HbA1C was 9.15±0.78%.

Conclusions: Stricter compliance to the treatment will go a long way in avoiding occurrence of the dreaded complication in type 2 diabetes patients.

Keywords: Diabetes ketoacidosis, Type 2 diabetes, Clinical profile

INTRODUCTION

Diabetic ketoacidosis (DKA) is a well-known, life-threatening acute complication of type 1 diabetes. For a long time, it has been considered the hallmark of type 1 diabetes; however, recently, its presence has been increasingly recognised in patients with type 2 diabetes and a newer entity called “ketosis prone type-2 diabetes” is also commonly recognised, which was first purported as an entity in the 80's.^{1,2} It is important to acknowledge that DKA can occur in type 2 diabetic patients as well, as this will have implications for acute management as well as planning for further follow up and treatment. This is especially relevant in India, with the longer life expectancy

and the increasing prevalence of diabetes and with type 2 diabetes said to account for more than 90 percent of all diabetes cases.³⁻⁵

DKA remains one of the most frequently encountered diabetes related emergencies and, despite updates in management and increasing standardisation of care, still has an appreciable morbidity and mortality.¹ In fact, the “Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (2003)” had estimated that the hospitalizations for DKA have increased during the past 2 decades and the major reason of this may be related to the increased prevalence of type 2 diabetes.⁶

The clinical parameters of DKA are said to vary majorly in type 1 and type 2 diabetes cases, something which has clinically significant impact on the line of management in acute crisis.^{7,8} There is dearth of insight into this important research query. This study was therefore undertaken to analyse the clinical profile of type 2 diabetes patients presenting with diabetic ketoacidosis at the time of presentation.

METHODS

The present study was an analytical, cross-sectional study conducted at ACPM Medical College, Dhule, Maharashtra over the period of two years (from November 2017 to October 2019). Due approval from the institutional ethics committee was taken before commencement of the study. All the type 2 diabetes patients with diabetic ketoacidosis admitted during the period at the study hospital constituted the study population. Following selection criteria were adopted for the selection of study sample: patients less than 18 years in age, those with alcoholic ketoacidosis, starvation ketoacidosis, lactic acidosis, ethylene glycol poisoning along with those not willing to participate were excluded from the study. Informed written consent was elicited from all the enrolled participants (or legal guardian- if the patient is not in a state to give consent). A total of 60 such patients were part of final study sample and were enrolled sequentially from the hospital OPD/emergency.

Those >18 years and previously diagnosed as having diabetes and at some time in their disease, other than a time consistent with the “honeymoon period”, were managed with diet and exercise alone or with hypoglycemic drugs, or were noncompliant with their insulin regimen for more than 3 weeks preceding admission were considered as Type 2 Diabetic for the study purpose (operational definition). A careful and detailed clinical history was recorded and thorough physical examination was conducted. Random blood sugar and glycated haemoglobin (HbA1C) were checked. Chest X-ray and electrocardiography (ECG) were undertaken on the basis of clinical requirement. Vitals and urine output were assessed periodically. Clinical criteria were adopted from the broader definition for the diagnosis of diabetes ketoacidosis.⁹

The data were analysed using statistical program for social science statistical software (SPSS) (version 16) and were presented as frequency and percentage distribution. Comparison of mean between parameters was done using unpaired-t test and analysis of variance (ANOVA). A level of significance of p<0.05 was considered as statistically significant.

RESULTS

Out of the total 60 type 2 DM patients with DKA who participated in the study, 53.3% patients belonged to 51 to 60 years age group, followed by 23.3% belonging to 41 to

50 years. There were 13.3% DKA patients above 60 years and 10% were below 41 years. Mean age of type 2 DM patients with DKA was 54.32±8.05 and ranged within 38 to 73 years. With respect to the gender distribution, 55% were males and 45% were females (ratio 1.2:1) (Table 1).

Table 1: Age and gender distribution of the participants.

Characteristics	Frequency (n=60)	Percent
Age (completed years)		
Up to 40	6	10.0
41 to 50	14	23.3
51 to 60	32	53.3
>60	8	13.3
Total	60	100.0
Gender		
Female	27	45.0
Male	33	55.0
Neutral	0	0
Total	60	100.0

With regards to the symptomology, all the patients had fruity breath odour at the presentation. Nausea in 86.7% and vomiting in 80% patients were the next common symptoms. There was polyuria in 45% patients and 41.7% patients complained of weight loss and breathlessness, followed by polydipsia (40%), abdominal pain and fever (38.3% each). Complaint of myalgia was noticed in 18.3%, urgency in 15%, dizziness in 13.3%, bloating of abdomen in 11.7% and cough and syncope in 10% and 8.3% patients respectively (Figure 1).

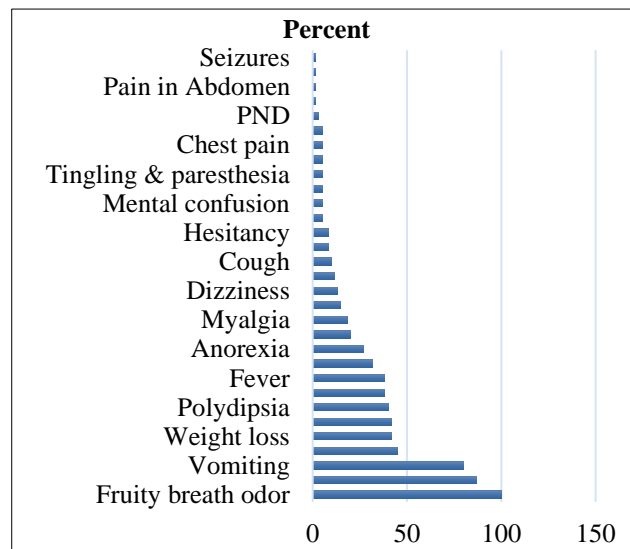


Figure 1: Symptomatology in type 2 DM patients with DKA (N=60).

On examination, there was pallor in 58.3%, skin retraction >2 seconds in 23.3%, while tongue was dry in 36.7%. Obesity was present in 48.3% and Kussmaul breathing in 90% of patients. Focal neurological deficit was found in

5% patients while abdominal tenderness was in 38.3% patients. Systemic examination revealed signs of pneumonia in 25% patients on respiratory system examination, 6.7% had ST elevation/T inversion in ECG. Out of 60 DKA patients, 5% were in coma, 20% were drowsy, 10% were stuporous, while remaining 65% were alert. Chest X-ray finding of opacity was observed in 25%, while 6.7% had pulmonary edema (Table 2).

Precipitating factors of DKA in type 2 DM patients were poor compliance to treatment in 51.7%, pneumonia in 25%, while 21.7% had urinary tract infection. Stroke and diabetic ulcer were present in 5% cases. 6.7% had myocardial Infarction while 1.7% had peri-anal abscess. Past history of similar illness was present in 18.3% patients; 58.3% were on anti-hypertensive treatment, 5% had IHD, 8.3% had history of stroke while obesity was present in 48.3% patients. Duration of DM in patients of DKA was 0 to 5 years in 48.3%, 40% had it for 6 to 10 years and 11.7% had duration within 11 to 15 years. There was family history of DM in 68.3% patients and HTN in 41.7% patients. Out of 60 Type 2 DM patients with DKA, 18.3% were smokers, 16.7% were tobacco chewers while 20% were alcoholics. Around 2/3rd (68.3%) were on oral hypoglycemic agents (OHA), 10% were on OHA and insulin, while 21.7% were newly diagnosed. Omission of treatment of DM was noted in 46.7% type 2 DM patients with DKA.

On evaluation, mean BMI of type 2 DM with DKA was 29.0±4.35 kg/m², pulse was 114.1±11.03 beats/min, systolic BP (SBP)/diastolic BP (DBP) was 119.9±8.8/74.37±8.03 mm of Hg, respiratory rate (RR) was 21.53±2.8/min. Blood examination revealed that mean Hb was 11.04±0.78 gm/dl, TLC was 9278.9±4081.8

cells/mm³. Mean urine output of patients was 1126.83±542.05 /day. Mean RBS in type 2 DM patients with DKA was 510.8±153.5 mg/dl and mean HbA1C was 9.15±0.78 % (Table 3).

Table 2: Signs in type 2 DM patients with DKA (N=60).

Sign	Frequency	Percent
Pallor	35	58.3
Skin retraction >2 secs	14	23.3
Dry tongue	22	36.7
Ulcer	3	5.0
Obesity	29	48.3
Kussmaul breathing	54	90.0
Focal neurological deficit	3	5.0
Abdominal tenderness	23	38.3
Signs of pneumonia	15	25.0
STEMI, T inversion	4	6.7
Consciousness level		
13-15 (alert)	39	65.0
10-12 (drowsy)	12	20.0
6-9 (stupor)	6	10.0
3-5 (coma)	3	5.0
Chest X-ray		
Opacity	15	25.0
Pulmonary edema	4	6.7

Out of 60 type 2 DM patients with DKA, 41.7% had 1+ urine ketone bodies, 36.7% had 2+ ketone bodies, 3+ ketone bodies were in 15% patients while 6.7% had 4+ urine ketone bodies. HbA1C was within 6.5 to 7.5 in 5% patients, 21.7% had it within 7.6 to 8.5, 28.3% had it within 8.6 to 9.5 range and 45% patients had HbA1C above 9.5.

Table 3: Basic parameters in type 2 DM patients with DKA.

Parameter	N	Minimum	Maximum	Mean	Standard deviation
BMI	60	22.49	38.08	29.0	4.35
Pulse	60	97	134	114.10	11.03
SBP	60	90	136	119.90	8.80
DBP	60	52	88	74.37	8.03
RR	60	14	28	21.53	2.80
Hb	60	9	13	11.04	0.78
TLC	60	5398	24500	9278.9	4081.8
Urine output	60	100	2100	1126.83	542.05
RBS	60	330	940	510.8	153.5
HBA1c	60	7	11	9.15	0.78

DISCUSSION

The present study compiled the clinical findings of type 2 diabetes patients presenting with diabetic ketoacidosis at the study centre over 2 years. Maximum participants were found in the age group 51 to 60 years i.e. 53.3% followed by 23.3% in 41 to 50 years age group, 10% in below 41 years age group and 13.3 % patients had age >60 years

(mean age 54.32±8.05 years). This was similar to studies conducted by Faich et al and Kreisberg et al.^{10,11} In further agreement closer home, Sonawani et al, in an Indian study, reported most common age group of type 2 DM patients presenting with DKA to be in the range of 51-55 years.¹² Out of 60 total patients in the present study, 33 (55%) were male and 27 (45%) were female (male to female ratio was 1.2:1). This was similar to study by Seth et al, who had

observed in their study of DKA patients that 34 i.e., 56.66% were males and 26 i.e., 43.33% were females, with the male: female ratio being 1.3:1.¹³ Narasimham et al reported male to female ratio to be 1:1; while Kitabchi et al and Sobngwi et al in their studies had reported a female predominance.^{1,14,15}

With regards to presenting symptoms, nausea was present in 86.7%, vomiting in 80% patients. There was polyuria in 45%, 41.7% complained of weight loss and breathlessness, polydipsia was in 40%, abdominal pain and fever was complained by 38.3% DKA patients. The predominance of observed symptoms in the present study is largely in line with previously similar studies.^{12,13,15,16}

On examination, there was pallor in 58.3%, skin retraction >2 seconds in 23.3%, while tongue was dry in 36.7%. Obesity was present in 48.3% and Kussmaul breathing in 90% of patients. Adhikari et al had observed 100% of the patients to be having Kussmaul breathing at the time of presentation.¹⁶ Other signs were fairly common across previously similar studies.¹²⁻¹⁴ Most of the patients are alert in consciousness at the time of presentation. Fairly high degree of suspicion on the basis of observation of clinical symptoms and signs helps in establishing early clinical diagnosis of DKA.

In our study, among the 60 patients 27 (45%) patients were having the HbA1c level more than 9.5 % and 17 patients (28.3%) were having HbA1c level in between 8.6–9.5%. In fact, poor compliance to treatment (51.7%) was observed to be the single largest precipitating factor towards occurrence of DKA in type 2 DM patients; followed by pneumonia in 25%, urinary tract infection in 21.7%. Sonawani et al reported poor compliance (45%) as the commonest precipitating factor followed by pneumonia (24%) and UTI (22%); much like our observations.¹² Adhikari et al and Welch et al stressed upon the requirement of multiple precipitating factors to be required in diabetic patients to develop DKA.^{16,17} Matoo et al reported infection (30%) to be the commonest precipitating factor in DKA, out of other multiple factors.¹⁸ Many patients who were non-compliant to treatment also had infection or other precipitating conditions.

In present study the maximum number of patients i.e., 48.3% had duration of diabetes ranging from 0 to 5 years with mean of 6.96±2.69 years, similar to previous studies. Past medical history of similar illness was present in 18.3% type 2 DM with DKA patients, an observation noted by previous researchers. Around 58% patients were hypertensive and on treatment, while 5% had history of IHD and 8.3% had history of stroke. This was similar to Sonawani et al who had reported past history of hypertension in 60%, followed by history of stroke in 7% and IHD in 5%.¹²

Around 2/3rd (68.3%) of all the participants were on oral hypoglycemic agents (OHA) and 10% were on OHA and insulin. In agreement to present study, Sonawani et al had

reported 70% patients to be on OHA and 10% on insulin and OHA.¹² The percentage of patients newly diagnosed with the current episode ranged between 26-30%, as per available literature from previous studies, slightly higher than our observation of 21.7%.¹²⁻¹⁸

In present study of type 2 DM patients with DKA obesity was present in 48.3% patients with mean BMI of 29±4.35 kg/m². Newton et al had noted that 25% patients to be having BMI >27 at the time of discharge.⁷ Narasimham et al described in their study that majority of the patients with type 2 diabetes who experience ketoacidosis were obese; whereas the type 1 patients with DKA were observed to be predominantly lean.¹⁴ Systolic and diastolic blood pressure and respiratory rate were observed to be on the expected lines in DKA. The blood examination revealed mean RBS to range between 510.8±153.5 mg/dl in the present study; also similar to observations of previous studies. The mean urine output of patients was 1126.83±542.05 /day was slightly on the higher side for reasons unknown. The patients were hospitalized for duration of 3 to 6 days with mean duration of hospitalization of 4.31±0.77 days. This was similar to Newton et al who noted an average hospitalization of 4.5±3.3 days, consistent with the CDC's national average length of stay for DKA of 4.5 days.^{7,19}

The present study had following limitations: Firstly, the number of participants is limited and may not be adequate for further sub-grouping. Secondly, it's a single centre study, while a multicentre study is desirable for the intended objective.

CONCLUSION

In conclusion it can be said that, diabetic ketoacidosis in type 2 diabetes patients is relatively commoner in elderly males, presents with very high level of sugars and HbA1c. Stricter compliance to the treatment will go a long way in avoiding occurrence of this dreaded complication.

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Conflict of interest: None declared

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

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