

Profile of precipitating factors in Diabetic Ketoacidosis: Data from a rural teaching hospital

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ABSTRACT

Background: Diabetic ketoacidosis (DKA) is a known presenting clinical feature of type 1 Diabetes mellitus (T1DM). It is a common acute medical complication in already known patients of all types DM, especially after altering / stopping the therapy and any infective etiology.

Objective: To describe the profile of precipitating factors of DKA.

Methods: This retrospective descriptive study was done in Department of Medicine, of a rural teaching hospital. Precipitating factors were identified by clinical examination & laboratory investigation in hospitalized & diagnosed cases of DKA.

Results: Among 50 patients, 22 were males. The mean age was 38.3 ± 15.7 years. 10 patients (20%) were diagnosed as DM for the first time during hospitalization and rest were already known diabetic.

Severe DKA was not common. A Major precipitating factor was an infection (40%) and next was noncompliance (28%). Less common factors included acute pancreatitis, myocardial infarction, surgery and stroke. No definite factor could be found in 14% patients.

Conclusion: Commonest precipitants of DKA were infection & non-compliance. Hence, it may be stated that with appropriate patient counselling about compliance to therapy and management of any illness, many cases of DKA may be avoidable.

Key words: Diabetic ketoacidosis, Diabetes mellitus, Risk factors, Precipitating factors.

INTRODUCTION

One of the commonest, serious but potentially preventable acute medical complications of diabetes mellitus (DM) is Diabetic ketoacidosis (DKA).^{1,2} Routinely already known cases of all types of DM presents with this complication, but Type 1 DM patient may also develop it.³ Biochemically major features include high blood sugars, increased ketone levels in blood & urine and metabolic acidosis.

Common presenting symptoms are nausea & vomiting, abdominal pain, increased thirst, frequency of urine and weakness. Clinically the patient can have dehydration, hypotension, breathlessness and features of any infection, finally developing coma.

One of the commonest precipitating factors for DKA is an infection, next common being non-adherence to treatment.^{1,3} Stroke & acute myocardial infarction, causing tissue necrosis, can also precipitate DKA.^{2,4} However in most of the patients no definite cause can be detected.^{1,5}

Therapy of DKA involves re-dehydration therapy, correction of high blood sugar & electrolyte imbalance and treating precipitating factor. Morbidity and mortality of patients developing DKA are now less than 10%, with the use of newer modalities of management & invention of newer insulin.

Prognosis depends upon age of patient, timely initiation of treatment, disease severity, co-existing illness and nature of underlying cause.⁶⁻⁸

In the present study, we have attempted to evaluate the profile of precipitating factors of DKA.

MATERIALS AND METHODS

This retrospective descriptive study was done in Department of Medicine, of a rural teaching hospital, on 50 patients. Previously diagnosed or undiagnosed diabetic patients hospitalized with the diagnosis of DKA were included in this study from the Intensive Care Unit of the department of Medicine.

Exclusion Criteria: Patients with other causes of metabolic acidosis (e.g. renal failure)

The severity of DKA was estimated by measuring arterial blood pH, on arterial blood gas analysis (<7 as severe, 7-7.24 as moderate, 7.25-7.3 as mild).

A comprehensive case history was recorded on a semi-structured, close-ended proforma. Data were collected in a preformed, pretested case record form which included patients' demographic profile, clinical information and laboratory investigation values.

Statistical Analysis: Data was cleaned, coded and analysed using 'SPSS for Windows' version 16.0. Descriptive statistics using frequency distribution was

performed. All data were expressed as mean, standard deviation (SD), range, and percentage.

Ethical Issue: Prior to commencement of the study, the protocol was approved by the local institutional ethics committee.

RESULTS

53 patients were hospitalized with a clinical diagnosis of DKA, during the study period, but 3 patients did not fulfil criteria for DKA. Hence, at the end 50 patients were enrolled for the study, including 22 males. The mean age of the eligible patients was 38.3 ± 15.7 years. Twenty two (44%) patients were from rural area. The majority of the patients (47, 94%) belonged to middle & lower socio-economic group.

Table A shows the status of DM of study patient group. 40 (80%) patients were already diagnosed to be diabetic whereas 10 (20%) were diagnosed as diabetic for the first time during present hospitalization. Among already diagnosed diabetic patients 20 (50%) were using insulin since the time of diagnosis. 3 (7.5%) diabetic patients were practicing medical nutrition therapy (MNT). 10 (25%) diabetic patients were using oral antidiabetic

drugs (OAD) at the beginning, but later on, shifted to insulin therapy. 7 (17.5%) diabetic patients were being treated with oral antidiabetic drugs (OAD) only. Prominent clinical features included nausea (47, 94%), weakness (46, 92%), vomiting (37, 74%), breathlessness (34, 68%), increased thirst (34, 68%), frequency of urine (31, 62%), fever (27, 54%), visual disturbances (26, 52%), weight loss (22, 44%), cramps in leg (13, 26%) and altered sensorium (16, 32%). Coma was detected in 2 (4%) patients only.

Blood sugar level was uncontrolled in all patients (**Table A**). At the time of hospitalization, high levels of ketones were detected in the urine of majority of the patients (40, 80%). Severe acidosis was found in 5 (10%) patients (**Table B**). Low sodium and high potassium levels were found in 3 (6%) patients and 4 (8%) patients respectively. Total leukocyte count was above 11,000/cmm in 43 (86%) patients. A major precipitating factor was an infection (20, 40%) and next was noncompliance (14, 28%).

Other causes were relatively insignificant (**Table C**). Infective causes were urinary tract infection (13, 26%), pulmonary tuberculosis (3, 6%), pneumonia (2, 4%) & liver abscess (2, 4%).

Table A: Status of DM of the study population (Number=50)

	Frequency	Percentage (%)
Diabetes status		
Newly detected DM	10	20
Known DM	40	80
Treatment of known DM		
MNT	3	7.5
OAD	7	17.5
Insulin	30	75
RBS at presentation (mmol/L)		
<20	0	0
21--25	9	18
26--30	15	30
31--35	25	50
>35	1	2
Mean 32.1 ± 7.5		
HbA1c (%)		
<8.5	2	4
8.6--10	10	20
>10	38	76
Mean 12.3 ± 2.5		

Table B: Severity of DKA (Number =50)

pH	Frequency	Percentage
<7.0	5	10
7.0 - 7.24	29	58
7.25 - 7.30	16	32

Table C: Precipitating factors of DKA (Number =50)

Factors	Frequency	Percentage
<i>Infection</i>	20	40
UTI	13	26
Pulmonary tuberculosis	3	6
Pneumonia	2	4
Liver abscess	2	4
<i>Noncompliance</i>	14	28
Omission of insulin	11	22
Reduction of insulin dose	3	6
<i>Myocardial infarction</i>	4	8
<i>Stroke</i>	2	4
<i>Pancreatitis</i>	2	4
<i>Surgery</i>	1	2
Unidentified	7	14

DISCUSSION

The present study was carried out to describe the profile of precipitating factors of DKA. Female patients were more than 50%. In Denmark, Female: Male ratio was 7.2:5.7.⁷ In Taipei, 67% DKA patients were females.⁹ A recent study also showed that DKA occurred more commonly in females.³

This shows that in resource-limited populations setting, long-term adherence to medications for chronic diseases like DM is very difficult, especially for poor female patients from the village.

However, an Indian study in paediatric age showed that occurrence of DKA is 2 times more common among males.¹⁰

In our study, nausea, vomiting and weakness were more common features of DKA; than its typical predominant features of increased thirst, frequency of urine & loss of weight. Clinical features of an infective cause (like fever) were also present. Blood sugar levels were very poorly controlled, as evident from mean HbA1c more than 12% in most of the patients. HbA1c was less than 8% in 2 patients, who were hospitalized due to acute pancreatitis. In a study from Kenya, more than 90% patients had HbA1c more than 80%.¹¹

In our study, gross electrolyte imbalance was not detected in most of the patients having mild to moderate acidosis. Most of the patients showed mildly raised or high normal serum potassium levels, mildly low or normal serum sodium levels. Similar findings were reported from a study in Pakistan.¹²

In our study, 5 patients developed severe metabolic acidosis, 3 patients had very low serum sodium levels, and 4 patients had very low serum potassium levels. However, after correction therapy, most of the patients developed low serum potassium levels. Two other studies have also reported similar findings.^{7,13}

In our study, almost all patients showed high white blood cells counts with neutrophil predominance.

However infective aetiology could be established in only 40% patients. In other study population about 65% study subjects had high white blood cells counts and no infective aetiology was found in 55% patients.¹⁴

We found infection as the most common precipitating factor, non-adherence to therapy being the next common factor. No definite precipitating factor was found in 7 patients and other factors were relatively less frequent. Rahim et al reported about 33% patients had infective etiology, about 33% had poor adherence to insulin therapy and no definite precipitating factor found in about 25%.³

In a study from Kenya, about 34% patients were non-compliant to insulin therapy, 23.4% had infective focus.¹¹ Even in studies from India and Korea, the most common cause was poor adherence to therapy.^{2,8} A study in Pakistan reported that among type 2 diabetes mellitus patients, 63% developed DKA due to infection.¹²

Our study had few limitations. Small patient population from single centre was studied. Study patients were not categorised as type 1 or type 2 diabetes mellitus. We have not evaluated monitoring of treatment and outcome.

We may conclude that the patients diagnosed with DM, who develop an infection or are non-compliant / poor compliant to insulin therapy, are more likely to get DKA. But new cases are also common. The Typical clinical presentation is less common. These patients had poor blood sugar control, but they had a less common occurrence of severe metabolic acidosis and gross electrolyte imbalance. In spite of not having any infection, high white blood cells counts were observed. Therefore, it may be said that most of the cases of DKA are preventable by proper patient education regarding the importance of treatment compliance and sick days' management.

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REFERENCES

1. Mudry S, Rambiritch V, Mayet L. An identification of the risk factors implicated in diabetic ketoacidosis (DKA) in type 1 and type 2 diabetes mellitus. *SA Fam Pract* 2007;49(10):15.
2. Rao V, Pradhan B, Mallikarjuna Y, Reddy R. Clinical profile of diabetic ketoacidosis in adults. *Nepal Journal Online* 2012;10(2):80-86.
3. Rahim M, Uddin K, Zaman S, Musa A, Rahman M, Hossain M et al. Clinical spectrum and management of diabetic ketoacidosis: experience in a tertiary care hospital. *Birdem Med J* 2011;1(1):15-20.
4. Umpierrez G, Kitabchi A. Diabetic ketoacidosis: risk factors and management strategies. *Treat Endocrinol* 2003;2(2):95-108.
5. Barski L, Nevzorov R, Rabaev E, Jotkowitz A, Boehm I, Zektser M et al. Diabetic ketoacidosis: clinical characteristics, precipitating factors and outcomes of care. *IMAJ* 2012;14(5):299-303.
6. Hardern R, Quinn N. Emergency management of diabetic ketoacidosis in adults. *Emer Med J* 2003;20(3):210-213.
7. Henriksen O, Prahl J, Roder M, Svendsen O. Treatment of diabetic ketoacidosis in adults in Denmark: a national survey. *Diabetes Res Clin Pract* 2007;77(1):113-119.
8. Ko S, Lee W, Lee J, Kwon H, Lee J, Kim S et al. Clinical characteristics of diabetic ketoacidosis in Korea over the past two decades. *Diabet Med* 2005;22(4):466-469.
9. Lin S, Lin J, Huang Y. Diabetic ketoacidosis: comparisons of patient characteristics, clinical presentations and outcomes today and 20 years ago. *Chang Gung Med J* 2005;28(1):24-30.
10. Jahagirdar R, Khadilkar V, Khadilkar A, Lalwani S. Management of diabetic ketoacidosis in PICU. *Indian J Pediatr* 2007;74(6):551-554.
11. Mbugua P, Otieno C, Kayima J, Amayo A, McLigeyo S. Diabetic ketoacidosis: clinical presentation and precipitating factors at Kenyatta National Hospital, Nairobi. *East Afr Med J* 2005;82(12 Suppl):191-196.
12. Jabbar A, Farooqui K, Habib A, Islam N, Haque N, Akhter J. Clinical characteristics and outcomes of diabetic ketoacidosis in Pakistani adults with type 2 diabetes mellitus. *Diabet Med* 2004;21(8):920-923.
13. Rahim M, Rouf R, Ashrafuzzaman S, Zaman S, Uddin K, Rahman M et al. Presentation, precipitating factors, management and outcome of diabetic ketoacidosis: a tertiary care hospital experience. *Bangladesh Med Coll J* 2012;17(2):65-71.
14. Mc Clarty D, Kinabo L, Swai A. Diabetes in tropical Africa: a prospective study, 1981-7.2: course prognosis. *BMJ* 1990;300:1107-1111.