ORIGINAL ARTICLES

PATTERN OF PRECIPITATING CAUSES OF DIABETIC KETOACIDOSIS IN A TERTIARY CARE HOSPITAL OF BANGLADESH

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Abstract

Background: *Diabetic ketoacidosis (DKA) is an established presenting feature of type 1 diabetes mellitus, but infection and non-compliance to anti-diabetic treatment remain the major precipitating causes of DKA among diagnosed diabetic patients. This study was designed to evaluate the precipitating causes of DKA occurring among adult patients.*

Methods: *This cross-sectional study was done in Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka, Bangladesh from 2008 to 2011. Diagnosed adult DKA cases were consecutively and purposively included in this study. Patients were evaluated clinically and by laboratory tests aiming at identification of precipitating causes along with management.*

Results: *Total patients were 200 with slight female (56%) predominance. Mean age of the study subjects was 37.6±7.5 years. Incidence of DKA was more in known diabetic patients (71%), more among rural population (53%) and low income group (76.5%). Infection (45.5%) was the commonest precipitating cause followed by non-adherence to anti-diabetic therapy (31%). Acute pancreatitis (5%), acute myocardial infarction (2%), stroke (1%) and surgery (1.5%) were less common causes and etiology could not be identified in 14% cases. Severe acidosis (pH < 7) was less common (8.5%). Neutrophil leukocytosis was present in 87% cases. Mortality was 6.5%.*

Conclusion: *Over two-thirds of DKA cases were precipitated by infection and non-compliance to anti-diabetic treatment in this study. In a significant number of cases, no cause could be identified. Acute pancreatitis appeared as an important cause of DKA in this study.*

Key words: *aetiology, diabetic ketoacidosis, precipitating causes.*

Introduction

Diabetic ketoacidosis (DKA) is one the most common and serious hyperglycemic emergencies among patients with diabetes mellitus (DM). Most of the type 1 diabetic patients first present with DKA[1], but DKA commonly complicate previously diagnosed diabetic patients of any type, especially if they get infection or become non-compliant to insulin treatment.[2-4] In a significant number of cases no cause might be identified.[4] Tissue necrosis like stroke, acute myocardial infarction and acute pancreatitis may precipitate DKA.[4,5] Treatment of DKA is aimed to correct dehydration, hyperglycemia, electrolyte imbalance and infection, if present.

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Outcome depends on rapidity of diagnosis andinitiation of appropriate treatment, severity of the disease, age of the patient, identification of precipitating factor and its treatment, presence of co-morbidities and organ dysfunction.[6-8]This study was designed to evaluate the precipitating causes of DKA among adult patients in a tertiary carehospital of Bangladesh.

Methods

This cross-sectional study was done in the Department of Internal Medicine, Department of Endocrinology and Department of Critical Care Medicineof Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka, Bangladesh from 2008 to 2011. Hospitalized adult patients (e"18 years) with a clinical diagnosis of DKA primarily constituted the study population. Diagnosis of DKA and classification was done by using American Diabetic Association (ADA) criteria[9]; mild DKA: an arterial pH of 7.25-7.30, moderate DKA: arterial pH 7.0-7.24 and severe DKA: arterial pH <7.0. Patients with ketonuria and high blood glucose with normal arterial pH were excluded from the study. Patients were evaluated clinically and common investigations including random blood glucose, glycated haemoglobin (HbA1c) (HbA1c <7% indicates good glycaemic control and HbA1c 7% or more indicates poor glycaemic control), urine for ketone body, arterial blood gas analysis, complete blood count, serum electrolytes, urea, creatinine, urine routine and microscopic examinations were done for all patients. Culture of appropriate samples and imaging were done as guided by clinical presentation, physical examination findings and reports of initial and routine investigations. All the data including socio-demographic characteristics (including monthly income; low income group <6000 taka, lower-middle 6000-<10,000 taka, middle 10,000-30,000 taka and high >30000 taka), clinical presentations, physical findings, laboratory parameters, treatment and outcome were recorded in semi-structured case record forms. Data were analyzed by statistical package for social sciences (SPSS) version 12.0 and results were presented in tables.

Results

Total number of patients was 200 including 88 males. DKA occurred mostly in diagnosed diabetic patients (142, 71%) than in new cases (58, 29%). Base-line characteristics of the study participants are presented in Table I.

Table I

Base-line characteristics of the study population (N=200)

Characteristics	Results
Mean age (years)	37.6±7.5
Male: Female	1:1.3
Known DM: New diagnosis of DM	2.4:1
Rural: Urban	1.1:1
Mean RBG at admission (m.mol/L)	27.1±7.5
Mean HbA1c (%)	11.3±3.7
Severe acidosis (pH <7)	8.5%

Note: DM= diabetes mellitus, RBG= random blood glucose

DKA occurred mostly among low income group (monthly income <6000 Bangladeshi taka, 76.5%) and patients with poor glycemic control (HbA1c >7% in 94%). Regarding anti-diabetic management of diagnosed diabetic patients, 88 patients were on insulin, 23 on oral anti-diabetic agents (OAD), 28 on both insulin and OAD and 3 patients were on medical nutrition therapy (MNT) only. Mild (72, 36%) to moderate (111, 55.5%) DKA were more common than severe (17, 8.5%) DKA.Common presentations are shown in Table II.

Table II

Clinical presentations of the study populations (N=200)

Features	Frequency (Percentage)
Nausea	126 (63)
Vomiting	122 (61)
Polyuria	86 (43)
Polydipsia	85 (42.5)
Fever	58 (29)
Abdominal pain	56 (28)
Shortness of breath	56 (28)
Blurred vision	26 (13)
Coma	14 (7)

Note: All patients had more than one symptoms

Infection (91, 45.5%) was the most common precipitating cause of DKA, both in previously diagnosed diabetic patients and new cases. Other causes are presented in Table III.

Table III

Precipitating causes of DKA among the study participants (N=200)

Causes	Total (200)	Diagnosed DM (142)	New (58)
Infection	91	51	40
UTI	67	39	28
Pneumonia	11	5	6
Pulmonary tuberculosis	6	3	3
Diabetic foot ulcer	4	3	1
Liver abscess	3	1	2
Non-compliance	62	62	---
Insulin omission	49	49	---
Non-judicious reduction of dose	13	13	---
Acute pancreatitis	10	2	8
Acute myocardial infarction	4	3	1
Surgery	3	3	0
Stroke	2	2	0
Unidentified	28	19	9

Neutrophil leukocytosis was present in 87% cases, irrespective of presence of infection. Gross electrolyte imbalance at admission was less common but 97% patients required potassium infusion during the hospital course. Overall mortality was 6.5%, more among patients with acute pancreatitis (6/10, 60%).

Discussion

This study was designed to evaluate the precipitating causes of DKA in a tertiary care setting of a developing country. We found that DKA occurred mostly in known diabetic patients, more in females and low incomegroup, which is consistent with two previous reports from Bangladesh.[4,5] In two different reports from Kenya[10]and Taiwan[11] almost similar picture is seen. Poverty and gender discriminations may contribute in availability of care for medical needs for chronic diseases like diabetes in developing countries like that of Bangladesh, which might be a contributory factor for such socio-demographic pattern of DKA cases.

In this study, DKA occurred mostly among previously diagnosed diabetic patients. This scenario is common in local studies[4,5,12] as well as in international reports.[13,14]

Precipitating causes of DKA were not different in this study from previous studies in Bangladesh.[4,5,12] Infection and non-compliance to anti-diabetic medications were common precipitants in the current study accounting for over three-fourth of cases. Almost similar picture was seen in different studies throughout the world.[13-18]Jabbar A *et al.*[19]found that in two-third of type 2 diabetic patients, DKA was precipitated by infection and after recovery from DKA; many of them were on OADs without recurrence of DKA. This observation explains that infection can unmask previously undiagnosed type 2 diabetic patients, as reported by Pinto ME *et al.*[17] In different studies it was found that, in up to 25% of patients with DKA precipitating cause could not be identified.[4,17]

Outcome of this study showed that 6.5% patients expired in hospital. Almost similar results were found in two different reports from Bangladesh.[4,5] Outcome of DKA is variable, depends upon time of diagnosis and onset of treatment, underlying causes and standards of care.[9] Mortality was 14% in UK[20], 11.8% in Korea[8] and 29.8% in Kenya.[10]With better understanding of the pathophysiology of DKA and improvements in treatment, outcome is improving.

Failure to classify patients as having type 1 or type 2 diabetes, especially those who were not previously diagnosed as diabetic, was an important limitation of the current study. Few of the study subjects had fibro-calcific-pancreatic-diabetes (FCPD) as well.

Conclusions

From the current study, it can be concluded that, DKA occurred mostly among known diabetic patients. Common precipitating causes were infection and non-adherence to anti-diabetic treatment. Failure to

identification of precipitant was not uncommon. Proper patient education regarding importance of treatment adherence and diabetic management during an inter-current infectioncan prevent many episodes of DKA and thus can reduce morbidity and mortality of diabetic patients.

Conflict of interest: Nothing to declare.

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