

Clinical Profile of Diabetic Ketoacidosis in Adults in Dhulikhel Hospital

Prajapati BK

Department of Medicine

Dhulikhel Hospital, Kathmandu University Hospital

Dhulikhel, Kavre, Nepal.

Corresponding Author

Bijaya Krishna Prajapati

Department of Medicine

Dhulikhel Hospital, Kathmandu University Hospital

Dhulikhel, Kavre, Nepal.

E-mail: bijayanp@gmail.com

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ABSTRACT

Background

Diabetic ketoacidosis is one of the life-threatening acute complications of diabetes mellitus. Despite the improvements in diabetic care, it remains a major clinical problem in clinical practice.

Objective

To assess the clinical and laboratory profile of adults with diabetic ketoacidosis in Dhulikhel hospital.

Method

This is a descriptive cross-sectional study including adult patients admitted in Dhulikhel hospital from July 2014 to July 2016 with the diagnosis of diabetic ketoacidosis according to the guidelines of American diabetes association. The hospital records of these patients were reviewed for their clinical and biochemical profiles.

Result

Forty eight patients fulfilled the criteria of diabetic ketoacidosis and were included in the study. Seventy three percent of patients had type 2 diabetes mellitus. Twenty three percent of the patients were cases of newly diagnosed diabetes mellitus. Polyuria and polydipsia as presenting complaint was more common in patients with type 1 diabetes mellitus ($p=0.002$) whereas fever was more common in type 2 diabetes mellitus patients ($p=0.03$). Majority of patients had normal serum sodium and potassium level. Forty two percent of the patients have high serum urea level and just over one third had high serum creatinine level. The most common precipitating factor of diabetic ketoacidosis for patients with type 1 diabetes mellitus was omission of insulin whereas in type 2 diabetic patients was infection.

Conclusion

Diabetic ketoacidosis is complication of both type 1 and type 2 diabetes mellitus. High degree of suspicion is needed for early detection of this life threatening condition especially in patients without history of diabetes mellitus.

KEY WORDS

Diabetic ketoacidosis, Type 1 diabetes mellitus, Type 2 diabetes mellitus

INTRODUCTION

Diabetic ketoacidosis consists of biochemical triad of hyperglycemia, ketonemia and metabolic acidosis. It is considered as one of the most serious acute complication of diabetes mellitus. Diabetic ketoacidosis remains a major clinical problem despite of improvements in diabetes care.¹

Incidence of diabetic ketoacidosis ranges from 4.6 to 8 episodes per 1000 patients with diabetes mellitus.^{2,3} Diabetic ketoacidosis has been considered as indicative of type 1 diabetes mellitus however recently there have been multiple reports that it can occur in both type 1 and type 2 diabetes mellitus.⁴⁻⁶ Majority of patients presenting with episodes of diabetic ketoacidosis have history of diabetes mellitus while 27% to 30% of patients have newly diagnosed diabetes mellitus diagnosed only during the episode of ketoacidosis.^{7,8} There have been estimations that hospitalization for diabetic ketoacidosis have increased during the past two decades, partly may be due to increase in prevalence of type 2 diabetes mellitus.^{9,10}

The mortality rate for diabetic ketoacidosis have fallen from 7.96% to 0.67% in the last two decades,^{11,12} however it remains high in developing countries. The crucial part in the management of diabetic ketoacidosis is early recognition of the clinical features and biochemical parameters of this condition. This study has been conducted to identify the common presenting symptoms and severity of patients presenting with diabetic ketoacidosis in Dhulikhel hospital so that treatment of this life threatening complication can be given timely.

METHODS

This is a descriptive cross-sectional study including all the patients above 18 years of age admitted in Dhulikhel Hospital with the diagnosis of diabetic ketoacidosis from July 2014 to July 2016. Patients were diagnosed as diabetic ketoacidosis if a) blood sugar level ≥ 250 mg/dl; b) serum bicarbonate level ≤ 18 mEq/L ; arterial pH ≤ 7.30 and d) urine ketones positive.¹³ The medical records of the patient fulfilling the diagnostic criteria were reviewed for demographic, clinical and laboratory profiles. The chief complaints during presentation to hospital, type of their diabetes mellitus, precipitating cause and severity of ketoacidosis were also reviewed.

Patients were labeled as type 1 diabetes mellitus if he/she required insulin for survival from time of diagnosis of diabetes mellitus;¹⁴ and as type 2 diabetes mellitus if they were previously diagnosed as having diabetes mellitus and at some time in their disease course, other than time consistent with the honeymoon period were managed with diet and exercise alone or were non-compliant with their insulin regimen for more than three weeks prior to admission.¹⁴ The patients were labeled as newly diagnosed

diabetes mellitus if he/she has never been diagnosed as diabetes mellitus before this admission. These patients were labeled as type 1 diabetes mellitus if their age was less than 40 years of age.

The episode of diabetic ketoacidosis was classified as mild, moderate or severe according to the criteria given by American Diabetic Association.¹³

This study was approved by the institutional review committee of Dhulikhel hospital, Kathmandu University hospital. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) 20.0 software for windows.

Table 1. Diagnostic criteria and severity of diabetic ketoacidosis.

	Diabetic ketoacidosis		
	Mild	Moderate	Severe
Plasma glucose(mg/dl)	> 250	> 250	> 250
Arterial pH	7.25 – 7.30	7.00 – 7.24	< 7.00
Serum bicarbonate (mEq/L)	15 – 18	10 to < 15	< 10
Urine ketones*	Positive	Positive	Positive
Anion gap	> 10	> 12	>12
Alteration in sensorial or mental obtundation	Alert	Alert/drowsy	Stupor/coma

* Nitroprusside reaction method

RESULTS

Forty eight patients fulfilled the diagnostic criteria of diabetic ketoacidosis and were included in the study. Over half of these patients were male (56%) and the mean age was 48.4 ± 15.8 years. Almost 40% of these patients were diagnosed as diabetes mellitus for less than five years duration. Twenty three percent of the patients were cases of newly diagnosed diabetes mellitus and 9% of them were type 1 diabetes mellitus.

The frequency of nausea, vomiting and abdominal pain as presenting complaints did not differ significantly between type 1 and type 2 diabetic patients, however type 1 patients were significantly more likely to present with polyuria and polydipsia than type 2 patients ($p = 0.002$) whereas type 2 diabetic patients demonstrated a trend ($p = 0.03$) toward a higher frequency of fever on presentation.

Table 2. Diabetic ketoacidosis episodes in different types of diabetes mellitus (n=48)

Types of diabetes mellitus	DKA episodes
Type 1 diabetes mellitus	12 (25%)
Type 2 diabetes mellitus	25 (52%)
Newly diagnosed diabetes mellitus	
Type 1 diabetes mellitus	1(2%)
Type 2 diabetes mellitus	10 (21%)

Table 3. Demographic profile of patients with diabetic ketoacidosis (n=48)

	Type 1 diabetes mellitus n (%)	Type 2 diabetes mellitus n (%)	Newly diagnosed diabetes mellitus	
			Type 1 diabetes mellitus n (%)	Type 2 diabetes mellitus n (%)
Gender				
Male	6 (12.5)	17 (35.5)	-	4 (8.5)
Female	6 (12.5)	8 (16.5)	1 (2)	6 (12.5)
Age group				
20 – 30	5 (10.5)	-	1 (2)	-
30 – 40	7 (14.5)	1(2)	-	1(2)
40 – 50	-	10 (21)	-	2 (4)
50 – 60	-	5 (10.5)	-	4 (8.5)
60 – 70	-	6 (12.5)	-	-
70 – 80	-	3 (6)	-	2(4)
80 – 90	-	-	-	1(2)
Hypertension				
-	-	18 (37.5)	-	4 (8.5)
Duration of diabetes mellitus				
<5 years	8 (16.5)	11(23)		
5 – 10 years	1(2)	10 (21.)		
>10 years	3 (6)	4(8.5)		

Table 4. Presenting complaints of diabetic ketoacidosis (n=48)

Symptoms	Type 1 diabetes mellitus n (%)	Type 2 diabetes mellitus n (%)	P value
Abdominal pain	9 (69.2)	22 (62.9)	0.688
Nausea/Vomiting	12 (92.3)	25 (71.4)	0.129
Fever	2 (15.4)	17 (48.6)	0.030
Shortness of breath	6 (46.2)	12 (34.3)	0.450
Altered sensorium	6 (46.2)	7 (20)	0.071
Polyuria/Polydipsia	11 (84.6)	12 (34.3)	0.002
Chest pain	1 (7.7)	3 (8.6)	0.900

P value was calculated by two sample t-test.

Majority of patients had normal serum sodium level (87%) and potassium level (69%). Hyperkalemia was seen in 18% and hypokalemia in 12% of patients. Forty two percent of the patients have high serum urea level and just over one third had high serum creatinine level (33%). Almost all of the patients (96%) had poorly controlled diabetes mellitus with high HbA1c level at the time of presentation. Patients with type 1 diabetes are more prone to develop severe ketoacidosis as compared to patients with type 2 diabetes mellitus (p = 0.008).

The most common precipitating factor of diabetic ketoacidosis for patients with type 1 diabetes mellitus was omission of insulin (46%) whereas in type 2 diabetic patients it was infection (57%). However in about one third of all cases (33%) the precipitating cause was not known.

Table 5. Laboratory profiles of patients with diabetes ketoacidosis (n=48)

Laboratory findings	Frequency		
	Low	Normal	High
Serum Sodium (mEq/L)	6 (12.5%)	42 (87.5%)	0 (0%)
Serum Potassium (mEq/L)	6 (12.5%)	33 (69.0%)	9 (18.5%)
Serum urea (mg/dl)	0 (0%)	28 (58.0%)	20 (42.0%)
Serum creatinine (mg/dl)	0 (0%)	32 (66.5%)	16 (33.5%)
Glycosylated hemoglobin A1c	0 (0%)	2 (4.0%)	46 (96.0%)

Table 6. Precipitating factor of diabetic ketoacidosis (n=48)

Precipitating factors	Frequency	
	Type 1 diabetes mellitus n (%)	Type 2 diabetes mellitus n (%)
Infection	3 (23.1)	20 (57.1)
Insulin omission	6 (46.1)	-
Unknown	4 (30.2)	12 (34.3)
Acute coronary syndrome	-	1 (2.8)
Stroke	-	2 (5.7)
Total	13 (100)	35 (100)

Table 7. Severity of diabetic ketoacidosis (n= 48)

	Degree of acidosis		P value
	Mild to moderate	Severe	
Type 1 diabetes mellitus	7	6	
Type 2 diabetes mellitus	31	4	0.008
Total	38	10	

P value was calculated by Chi-square test.

DISCUSSION

Our study showed that 73% of the cases of diabetic ketoacidosis admitted had type 2 diabetes mellitus which suggests that ketoacidosis is not only seen in type 1 diabetes mellitus; in fact it is more common in type 2 diabetes mellitus with mean age of 48.4±15.8 years. Rao VD et al. also demonstrated that 81% of the patients with diabetic ketoacidosis were type 2 diabetes mellitus.¹⁴ Similar finding was shown by Balasubramanyam et al by demonstrating that majority of the diabetic ketoacidosis patients were type 2 diabetics especially in non-white ethnic groups.⁶ However this finding may be due to the high prevalence of type 2 diabetes mellitus especially in South Asian population. The finding that 23% of the cases were newly diagnosed diabetes mellitus also suggests that diabetic ketoacidosis can be a presenting feature in diabetes mellitus. Umpierrez et al. showed that 17% of the patients with diabetic ketoacidosis were newly diagnosed cases of diabetes mellitus in urban black population in Africa.¹ The finding of Christopher A. Newton and Philip Raskin that 19.9% of diabetic ketoacidosis patients were newly diagnosed cases of diabetes mellitus was also not in contrast to this study.¹⁰ Patients with type 1 diabetes

present with polyuria and polydipsia ($p=0.002$) which are typical features of hyperglycemia whereas those with type 2 diabetes mellitus had fever as significant feature ($p=0.03$). This finding suggests that high degree of suspicion is needed for early diagnosis of this life threatening condition especially in patients with type 2 diabetes mellitus.

The most common precipitating factor of diabetic ketoacidosis in type 1 diabetes mellitus patients was omission of insulin therapy (46.1%) which was similar to the finding of Umpierrez et al (49%). The reason for insulin omission might be due to poor socioeconomic status or lack of proper knowledge regarding the disease. Infection was the most common precipitating factor in type 2 diabetes mellitus followed by no identifiable cause in 34% of the cases. The similar finding was demonstrated by Mishra et al. that there are ketosis prone type 2 diabetes mellitus usually with precipitating factor but can also occur without any identifiable cause.^{15,16} Patients with type 1 diabetes mellitus had more severe episodes of ketoacidosis as compared to those with type 2 diabetes mellitus which may be due to reason that these patients are not very aware of their disease condition and presented very late.

Diabetic ketoacidosis can occur in a well controlled diabetic patient but in our study it was seen that almost all the patients had HbA1c level above 7%. This suggests that in

our setting diabetic ketoacidosis might be more common in uncontrolled diabetes mellitus. Majority of the patients with diabetic ketoacidosis have history of diabetes for less than five years which is similar to the findings of Maskey et al.¹⁷ This might be due to the lack of proper knowledge about diabetes mellitus and its complication among the patients. The incidence of this life threatening condition may be decreased by proper management and education regarding the disease itself and its complications. In contrast to the usual belief, the study showed that majority of the patients had normal serum sodium and potassium levels. It might be due to the fact that majority of the patients (80%) had mild to moderate ketoacidosis in this study.

CONCLUSION

Diabetic ketoacidosis is a life threatening complication of not only type 1 diabetes mellitus but also of type 2 diabetes mellitus in contrast to traditional teaching. Majority of the patients with diabetic ketoacidosis had poorly controlled diabetes mellitus. Most of patients with type 1 diabetes mellitus have polyuria and polydipsia as their presenting features during DKA whereas type 2 diabetes mellitus do not so high degree of suspicion is needed to make early diagnosis of this serious complication in these group of patients.

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