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To Study Clinical and Bio Chemical Parameters of Diabetic Keto Acidosis Patients

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Abstract

Background: With the changes in the frequency of DKA and the increased incidence of DKA in patients with type 2 diabetes mellitus, the question arises regarding change in the clinical or laboratory characteristics of the patients with DKA. Hence this study was planned to explore the clinical and biochemical characteristics of patients with type 2 diabetes compared with type 1 diabetes admitted with DKA in a tertiary care hospital.

Material & Methods: The present study was a case control study with 50 Diabetic ketoacidosis patients as cases and 50 controls. The Inclusion criteria for cases was kept aspatients who were known diabetic either type I or type II and presenting with DKA or accidently detected. On admission, a careful and detailed history was recorded and thorough clinical examination was conducted. Additional information if any was recorded and were investigations carried out.

Results: Diabetes ketoacidosis develops in a significant number of Type II DM patients. Most common cause of diabetic ketoacidosis was infection (56%) followed by omission or irregular treatment (28%). Most common presenting clinical features were vomiting, abdominal pain,dehydration, acidotic breathing, altered mental status and fever. Total leucocyte count was significantly higher in DKA compared to control group. Serum sodium was significantly lower in DKA cases compared to control group. Clinical profile was similar in between Type I and Type II DM patients presenting as DKA.

Conclusion: Diabetes ketoacidosis develops in a significant number of Type II DM patients. Most common cause was infection and irregular treatment. Most common presenting clinical features were vomiting, abdominal pain, dehydration, acidotic breathing, altered mental status and fever. Overall mortality rate is 6% in diabetic ketoacidosis.

Keywords: Diabetes ketoacidosis, diabetes mellitus, serum sodium, leucocyte.

Introduction

Diabetic ketoacidosis (DKA) is most serious acute metabolic complication of diabetes. The patient may present with wide range of manifestations. An episode of diabetic ketoacidosis was once considered a hallmark feature that would differentiate individuals with type 1 diabetes mellitus from those with type 2 diabetes mellitus [1,2].

The clinical and biochemical characteristics of DKA have been previously well described; however, most patients included in these reports probably had type 1 diabetes mellitus.More recently, there have been multiple reports of DKA occurring in patients with type 2 diabetes mellitus. With the changes in the frequency of DKA and the increased incidence of DKA in patients with type 2 diabetes mellitus, the question may be posed of whether there has been any change in the clinical or laboratory characteristics of the patients with DKA[3,4].. Hence this study was planned to explore the clinical and biochemical characteristics of patients with type 2 diabetes compared with type 1 diabetes admitted with DKA.

Material and Methods

The present study was a case control study with 50 Diabetic ketoacidosis patients as cases and 50 controls. The Inclusion criteria for cases were kept aspatients who were known diabetic either type I or type II and presenting with DKA or accidently detected. For admission**,** patients has to meet all the following criteria:

(1) Hyperglycaemia> 250mg/dl

(2) Acidosis with blood pH <7.3

(3) Serum bicarbonate <15mEq/L

(4) Urine positive for ketone

On admission, a careful and detailed history was recorded and thorough clinical examination was conducted. Additional information if any was recorded and the investigations carried out were Complete Hemogram, LFT, RFT, Blood sugar, Serum electrolytes, ABG, ECG, X ray, Urine(R&M) and USG Abdomen.

All the data analysis was performed using appropriate statistical software. Quantitative variables were expressed as the mean and standard deviation.. Student t- test was used to compare the means. Chi Square test was used to compare the categorical data. P value of < 0.05 was considered as significant.

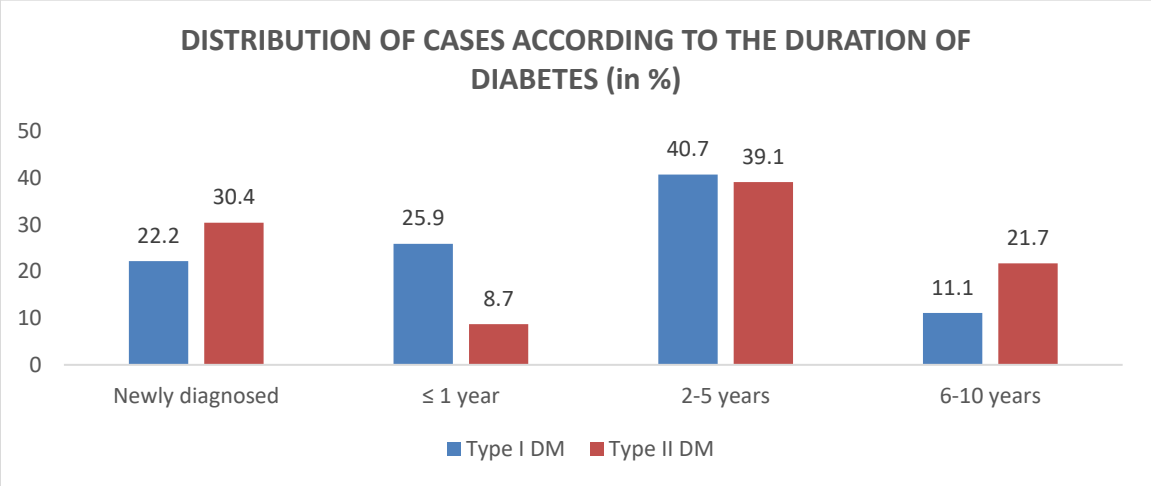
Results

Out of 50 cases of diabetic ketoacidosis 27 (54%) were classified as type 1 diabetes mellitus and 23(46%) as type 2 diabetes mellitus. In controls 10 (20%) patients were of type1 diabetes mellitus and 40(80%). patients are of type 2 diabetes mellitus. M: F ratio was 1:1 in both the groups.

Mean age of cases was 35.56±15.51 years, while in controls mean age was 43±13 years.

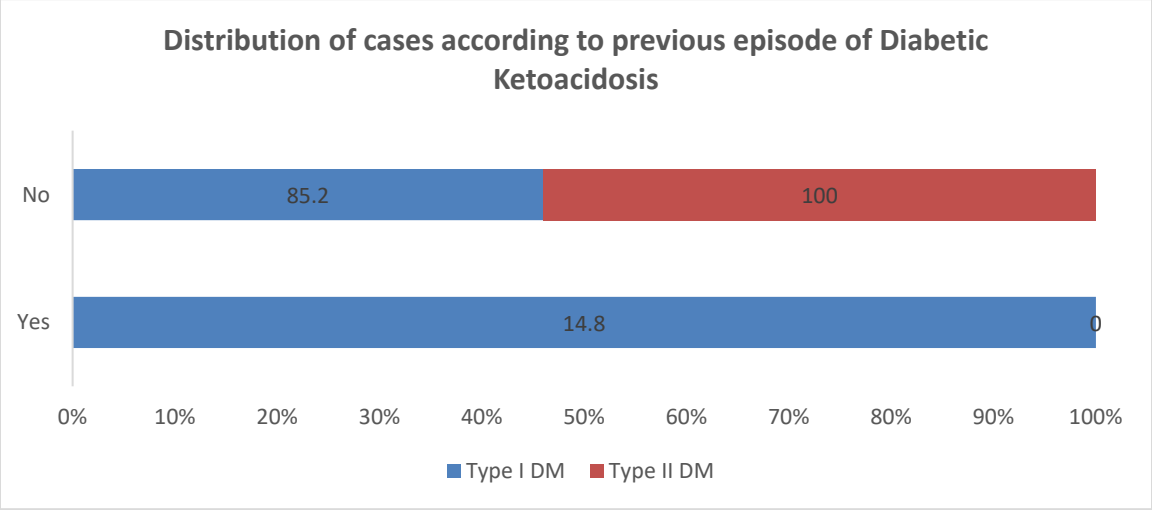
Maximum number of cases, 42 (84%) were in 14 - 40-year age group, while in controls majority of patients 38(76%) were in 14 – 50-year age group.

Figure 1: Distribution of cases according to the duration of diabetes



Maximum number of Type 1 DM cases 16 (59.3%) was in 21 - 30-year age group, while among Type 2 DM cases majority of patients 15(65.2%) were in 41 – 60-year age group. In the present study, 13(26%) cases first time presented in diabetic ketoacidosis. Maximum number of patients i.e., 20(40%) were diabetic for 2-5 years. Maximum duration of diabetes was 10 years among the population studied. Maximum number of cases, 19(28%) were on insulin alone and 13(26%) cases were first time diagnosed with diabetes during DKA episode.In controls, 5 patients were first time diagnosed with diabetes during there admission.

Figure 2: Distribution of cases according to previous episode of diabetic ketoacidosis



In Type 1 DM cases 4(14.8%) out of 27 had history of previous episode of DKA. In Type 2 DM cases history of previous episode of DKA was present in none of the patients.

Table 1: Precipitating factors in diabetic ketoacidosis

Precipitating factors	DM I (27)	%	DM II (23)	%	Total (50)	%
Irregular treatment (IT)	14	51.9	4	17.4	18	36.0
Infection: (INF)						
LRTI	1	3.7	5	21.7	6	12.0
UTI	1	3.7	6	26.1	7	20.0
GI	1	3.7	0	0.0	1	2.0
Malaria	2	7.4	0	0.0	2	4.0
TB	6	22.2	3	13.0	9	18.0
Typhoid	1	3.7	0	0.0	1	2.0
Diabetic foot	0	0.0	1	4.3	1	2.0
TBM	0	0.0	1	4.3	1	2.0
Total	12	44.4	16	69.6	28	56.0
Other: -						
CAD	0	0.0	2	8.7	2	4.0
CVD	0	0.0	2	8.7	2	4.0
Surgical(GOO)	1	3.7	0	0.0	1	2.0
Newly diagnosed	6	22.2	5	21.7	11	22.0
Unknown(UK)	2	7.4	4	17.4	6	12.0

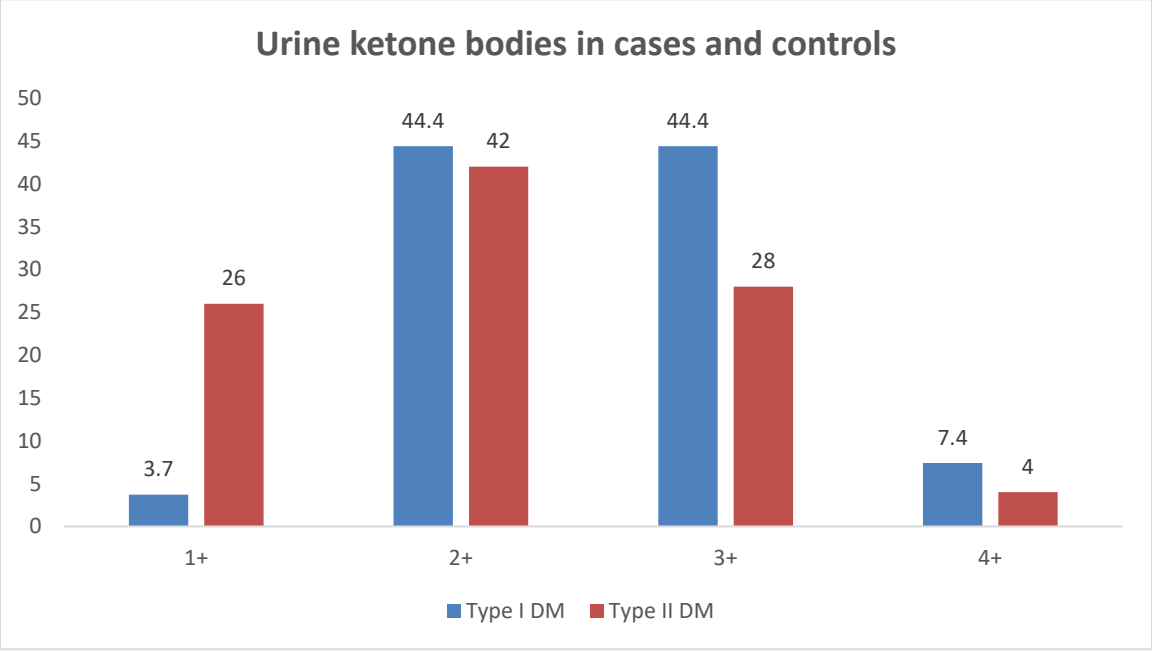
Commonest precipitating factor in Type 1 DM cases was irregular treatment 14(51.9%) followed by infection in 12(44.4%), while in Type 2 DM cases most common precipitating factor was infection in 16 (69.8%). Most common infection was urinary tract infection in 6 (26.1%) and lower respiratory tract infection in 5(21.7%).

Table 2: Clinical profile of cases and controls

Clinical Presentation	DM Type I	%	DM Type II	%	Total	%	Controls	%
Fever	10	37.0	7	30.4	17	34.0	14	28.0
Dehydration	17	63.0	15	65.2	32	64.0	3	6.0
Vomiting	12	44.4	10	43.5	22	44.0	5	10.0
Abdominal Pain	11	40.7	8	34.8	19	38.0	11	22.0
Acidotic breathing	12	44.4	6	26.1	18	36.0	0	0.0
Burning micturition	6	22.2	3	13.0	9	18.0	7	14.0
Cough	7	25.9	5	21.7	12	24.0	5	10.0
Conscious	10	37.0	14	60.9	24	48.0	49	98.0
Confused	13	48.1	8	34.8	21	42.0	1	2.0
Stupor	4	14.8	0	0.0	4	8.0	0	0.0
COMA	0	0.0	1	4.3	1	2.0	0	0.0

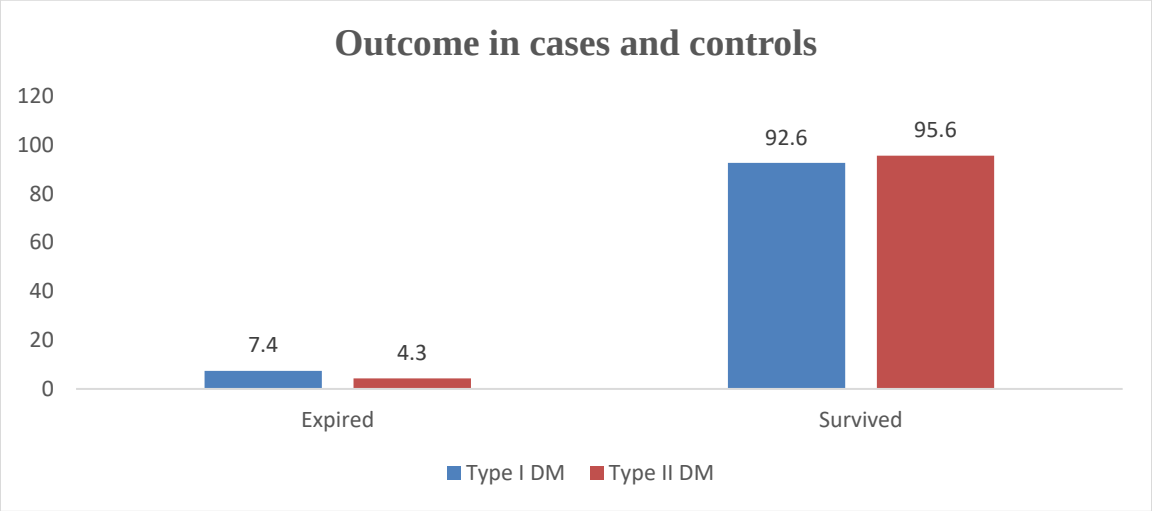
Out of 50 cases, 32 (64%) were dehydrated and 18(36%) were breathless at the time of admission.21(42%) cases were confused and 4 (8%) were stuporous at the time of admission, while 24(48%) patients were fully conscious at admission.

Figure 3: Urine ketone bodies in cases and control



In our study majority of Type 1 DM cases had urine ketone bodies 2+ i.e., 12 cases (44.4%) or 3+ i.e., 12(44.4%). In Type 2 DM cases majority i.e., 12 (52.9) had 1+ urine ketone bodies at admission. In controls 4 (8%) patients were having 1+ ketone and 45 patients out of 50 had no ketone bodies in urine.

Figure 4: Outcome in cases and controls



In type 1 DM cases, 2 (7.4%) expired and 25(92.6%) survived, while among Type 2 DM cases 1 patient expired out of 23. Overall, 3(6%) cases expired during course of hospitalisation.

Table 3: Comparison of mean of biochemical parameters between Type 1 DM, Type 2 DM cases and controls

	Type 1 DM	Type 2 DM	Total	Controls	P value*
Duration of admission (Days)	8.37±3.8	8.3±3.7	8.34±3.4	6±4.2	0.94
RBS (mg/dl)	504±77.2	458±91.6	483±89	224±80	0.08
TLC	11448.2±5161	10434±4929	10982±4818	9951±2096	0.45
Blood urea(mg/dl)	36.9±20.7	48.1±26.4	42.1±25.8	40.8±1.18	0.14
Serum creatinine(mg/dl)	1±0.27	1.04±0.5	1±0.5	0.9±0.27	0.80
sodium(mEq/L)	135.2±5.8	134.9±4.8	135±52	142±5.5	0.82
Potassium(mEq/L)	4.16±1	4.07±0.9	4.1±0.9	4.3±0.6	0.70
Arterial pH	7.18±0.1	7.21±0.08	7.2±0.1	7.37±0.07	0.18
Serum bicarbonate	13.1±3.2	15±3.13	13.9±2.9	27±3.4	0.02

Serum bicarbonate was significantly lower in Type 1 DM compared to Type 2 DM cases. No significant difference was observed in other biochemical parameters between Type 1 DM and Type 2 DM. In cases, mean TLC was observed as 10982 ± 4818/cu mm, while in controls it was observed as 8036 ± 3460/cu mm.Total leucocyte count was significantly higher in DKA cases compared to control group(p=0.00001). Serum sodium was significantly lower in DKA cases compared to control controlgroup(p=0.00001). No significant difference was observed in serum potassium, blood urea and serum creatinine in between cases and control group. There was a significant difference in blood sugar on admission, Serum bicarbonate and arterial pH between the patients who survived and expired.

Discussion

In this study mean age in type I DM cases is 23 years which is considerably lower than mean age in type II DM cases i.e50 years. Also, minimum age is 15 years in cases and the maximum age observed is 70 years. Overall maximum number of cases 42 (84%)

are in 14 - 40-year age group. In the present study, the mean ages of Type I DM, Type II DM and overall were 23.5±15.8, 50.39±15.5 and 35±15.8 years respectively. While in the study by Ashok *et al*[5] (1999) the mean ages were 35.5±10.1, 47.3±13.7 and 40.55 years and in the study by Elmehdawi*et al*[6] (2010),the mean ages found were 25.1, 32.6 and 29.2 years respectively.

In our study Male: Female ratio is 1:1. Most of other studies shows higher incidence in male compared to female. Ashok *et al*[5] (1999) described the ratio to be 8:3, while Seyoum*et al*[7] mentioned the ratio to be 5.8:2.3. A female predominance was noted in the study by Elmehdawi*et al*[6].

In our study out of 50 cases 27 were Type I DM cases and 23 are Type II DM. So DKA once observed as a hallmark feature of Type I DM is quite common in Type II DM. The rise in the prevalence of Type II DM is considered as main cause. Other studies like Elmehdawi*et al*[6]also observed similar result.

New onset Diabetes was observed in 22%. Christopher *et al*[2] reported 25.3% case as new onset. Out of those 90% were later diagnosed as Type II DM.

In our study 18% of Type I DM cases had history of DKA while no patient with Type 2 DM has history of DKA. Ashok *et al*[5]also observed Type I DM had more recurrence of DKA. Randall[8] in his study observed irregular treatment as the most important cause of recurrence.

In our study the most common symptoms were vomiting and abdominal pain with 44% and 38% respectively. The most commonly found signs were dehydration (64%), and acidotic breathing (36%). Abdominal pain was complained by 38% of patients. Altered mental status was found in 52% of patients. In one study the clinical features were as follows: - polyuria (75.2%), polydipsia (74.4%), polyphagia (33%), nausea (83.4%), vomiting (78.5%) and abdominal pain (51%). Similar findings were reported from the studies of Christopher *et al*[2]D Rao*et al*[9], Huri*et al*[10]andElmehdawi *et al*[6]

In this study commonest precipitating factor in Type I DM cases was irregular treatment 14(51.9%) followed by infection in 12(44.4%). The most common infection was Tuberculosis in 6(22.2%) cases. As per our knowledge no other study has documented such high prevalence of tuberculosis in DKA. In Type II DM cases most, common precipitating factor was infection in 16 (69.8%). Most common infection was urinary tract infection in 6 (26.1%) and lower respiratory tract infection in 5(21.7%). Overall infection 31(61%) was the most common cause.DRao*et al*[9] andHuri*et al*[10] also mentions infections as a major precipitating factor, while Christopher *et al*[2]and Seyoum*et al*[7]point towards irregular treatment.

The mean blood sugar in Type I DM cases was 504mg/dl and in type 2 DM it was 458mg/dl. Mean RBS and TLC are higher in Type I DM cases compared to Type II. Mean pH and Serum bicarbonate was lower in Type I DM cases compared to Type II. Christopher *et al* andAshok *et al*observed no significant difference in biochemical parameters between Type I DM and Type II DM cases[2,5].

Other study by Huri*et al*[10] observed lower serum level of glucose in previously diagnosed Type II DM cases than in Type I DM. Study also observed, previously diagnosed Type I DM have lower serum bicarbonate, lower arterial pH, higher anion gap and more ketone bodies in urine than previously diagnosed Type I DM. In Type I diabetes patients, as a consequence of increase production of ketoacids, acidosis might develop more severely than type II diabetes patients. This may be the reason because type I diabetes patients do not have insulin reserve to reduce ketogenesis. The ketoacids will dissociate and hydrogen ions

are released. These excess hydrogen ions will bind to the bicarbonate. As a result, the serum bicarbonate levels are decreased. When the bicarbonate stores are depleted, the blood pH will become lower. Apart from that, the excess ketone bodies are circulating in the blood in anionic form and this increases the anion gap. In addition, the abundant ketone bodies in the circulation will eventually lead to ketonuria. Therefore, patients with type I diabetes have greater ketone levels in urine compared with type I diabetes patients.

In our study 3(6%) patients expired out of 50. Other studies observed mortality rate between 3 to 6 %.Elmehdawi*et al*observed mortality rate significantly higher among patients with Type II DM, comorbidities, age>40, depressed level of consciousness at presentation, pulse rate >115/min, systolic blood pressure<105 mm of Hg, diastolic blood pressure <65mm of Hg, plasma glucose >525mg/dl, serum sodium >144mmol/L, blood urea >50mg/dl, serum creatinine >4mg/dl, arterial pH <7 and plasma osmolality 325mosm/kg water.

Conclusion

Diabetes ketoacidosis develops in a significant number of Type II DM patients. Most common presenting clinical features were vomiting, abdominal pain, dehydration, acidotic breathing, altered mental status and fever. Total leucocyte count was significantly higher in DKA compared to control group. Serum sodium was significantly lower in DKA cases compared to control group. Most common precipitating factor in Type I DM cases was irregular treatment while in Type II DM cases it was infection. Serum bicarbonate was significantly lower in Type I DM cases. Also, urine ketones were high in type I DM cases. It can be concluded that some of the clinical and biochemical parameters may indicate bad prognosis; most notably, severity of altered sensorium, comorbid condition, high blood sugar and severe acidosis.

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