

Diabetic Ketoacidosis Clinical Profile, Precipitating Events, Metabolic Abnormalities and Correlation with Treatment Outcome

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Abstract: Diabetic ketoacidosis (DKA) is one of the acute metabolic complications of diabetes. DKA occurs in the setting of severe insulin deficiency when low circulating levels of insulin lead not only to hyperglycemia and dehydration but also to the production of ketone body and acidosis. This is a prospective study to assess the clinical profile of diabetic ketoacidosis in patients admitted in general medicine and pediatrics wards/ICU of government medical college Calicut. DKA was seen in both type 1 diabetes and type 2 diabetes. First presentation as DKA was more common among type 1 diabetes. Most common precipitating factors include infections and omission of oral hypoglycemic agents or insulin. Altered sensorium at presentation was an independent predictor of mortality. Low pH, high RBS, hyponatremia, azotemia, high serum creatinine, hypophosphatemia, hypocalcemia and hypomagnesaemia all were associated with increased risk of mortality.

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

INTRODUCTION

According to the Indian Council of Medical Research-Indian Diabetes study, India currently has 62.4 million people with diabetes [1]. This epidemic of diabetes is unfortunately paralleled by a corresponding increase in the prevalence of its complications, which account for much of the premature morbidity and mortality due to diabetes in India [2]. Diabetic ketoacidosis (DKA) is one of the acute metabolic complications of diabetes. Diabetic ketoacidosis is a constellation of hyperglycemia, acidosis and ketosis. DKA occurs in the setting of severe insulin deficiency when low circulating levels of insulin lead not only to hyperglycemia and dehydration but also to the production of ketone body and acidosis.

DKA is the leading cause of death among patients with diabetes who are younger than 24 years old accounting for about one half of deaths in this population group[3]. The incidence of DKA continues to increase causing a huge economic burden. Even though DKA was initially thought to be the hall mark of Type 1 Diabetes mellitus, it can occur in Type 2 Diabetes Mellitus as well. Mortality among DKA has been related to age, level of consciousness on admission, severity of acidosis, degree of hyperosmolarity, severity of azotemia, and nursing home residence [4]. Mortality is predominantly due to underlying morbidity such as sepsis and myocardial infarction.

AIMS AND OBJECTIVES

- To study the clinical profile of DKA in patients admitted in Medicine and Pediatrics wards/ICU of Government medical college Calicut.
- To assess biochemical characteristics of the patients.
- To identify the precipitating factors for DKA.
- To correlate the biochemical parameters with the outcome.

MATERIALS AND METHODS

All patients admitted with a diagnosis of DKA in Medicine and Pediatrics wards/ICU were included in the study after obtaining an informed consent. A total of 55 patients (44 adults and 11 children) were included. The duration of the study was one year. The study was done based on a

proforma with particular emphasis on clinical features and precipitating features in all patients. Biochemical characteristics of every patient were noted at presentation. Patients were followed up during the period of hospital stay to look for outcome and complications

RESULTS & DISCUSSION

Of the 55 patients included in the study 11 patients were children and 44 patients were adults. Both groups were analyzed separately as the baseline characteristics of the two groups were not comparable of the total 55 patients, 28 (51%) patients had type 1 DM and 26 (47%) patients had type 2 DM and 1(2%) patient was detected to have diabetes during early infancy. (Figure 1) Among the adults, 26 (59%) were males and 18 (41%) were females. Majority of the patients, 20 (45.4%) were in the age group 41-60 years, 14 (32%) in the 13-25 age group, 4 (9%) in the 26-40 age group and 6 (14%) were above 60 years. In the adult population 26 (59%) were males and 18 (41%) were females. This gender distribution was comparable with the study by Gomez Diaz Ra et al which constitutes 52% males and 48% females. But many other studies report female predominance. This variation might be due to various factors including environmental, genetic and social differences between the cohorts.⁵ The mortality was 50% when the age was above 60 years with statistical significance (p value is 0.024). 59% of adult patients had type 2 diabetes mellitus and 39% had type 1 diabetes mellitus. 20.4% comprised of newly detected diabetes mellitus, all of whom were having type 1 diabetes. One patient had diabetes detected in the early infancy. G Gavrielatos et al from New Ionia also observed 18% of patients presenting with DKA had newly detected diabetes [6].

Majority of the patients, 39 (88.6%) had nausea and vomiting as presenting symptoms. 35 patients had increased thirst, 33 had polyuria, 31 patients had dyspnea and 21 patients had abdominal pain. Altered sensorium at presentation carried increased risk of mortality with high statistical significance (p value 0.000)

The most common precipitating factor was infection out of which lower urinary tract infection is seen in 34% patients, pyelonephritis in 9% and pneumonia was seen in 25% patients. Drug default was the cause in 19 patients. Drug induced DKA was not a rare entity which was seen in 9% patients. Olanzapine was the offending drug in three patients and prednisolone in one patient. The study by Sue -Fu Lin et al in Taipei also found out similar precipitating factors for DKA where common predisposing factors were infection and omission of anti-diabetic agents [7].

Twenty four % patients had myocardial infarction and 9% patients had cerebrovascular accident. Among previous comorbidities 11 patients had hypertension, 9 had coronary artery disease and 8 had diabetic nephropathy. 5 out of 44 patients present admission was the second episode of DKA. There was a significant positive correlation between duration of diabetes and mortality (p value is 0.002). Random blood sugar value was more than >300mg/dL in majority of patients (95.4%) at presentation. 16 patients had RBS value between 501 -700 mg/dl. More than 700mg/dL RBS was seen in only 2 patients. (Figure 2) Risk of mortality increased when the RBS value was more than 700mg/dL at presentation with a statistically significant (p value 0.032). This observation is consistent with study by Elmehdawi RR *et al.*[8] Eight patients had serum pH value between 7.25 to 7.3 and 23 had pH in the range of 7.15 to 7.24. Thirteen had pH value less than 7.15. Patients with pH value less than 7.15 had increased risk of mortality and p value was 0.04

Six patients had less than 10 mEq/L. Bicarbonate level less than 10mEq/L was associated with 50% increased risk of mortality with a p value of 0.006. Majority (90.9%) of the patients had sodium levels less than 140mEq/L. Sixteen cases had sodium levels less than 130mEq/L. One patient had less than 120mEq/L. Majority (68.18%) of the patient showed serum potassium levels less than 4mEq/L. A blood urea value of more than 30mg/dL is seen in 25 (56.8%) patients. Four patients had creatinine value more than 2mg/dl. 70 % of the patients had serum calcium value less than 9mg/dl. Majority of the patients had HbA1C more than 8.6% and 9 patients had value more than 11.5%.

One patient had deep vein thrombosis and two had aspiration pneumonia. Overall mortality is 13.6%. Of the 6 deaths, 3 were due to cerebrovascular accident. One patient had myocardial infarction and the other had aspiration pneumonia.

Among the pediatric population 45% were females and 55% were males. Newly detected diabetes was seen in 73% patients. Alvi et al showed that young Asian children had an eight fold increased risk of presenting with DKA as did non-Asian children.⁹ Majority of patients presented with nausea, vomiting, thirst and polyuria. This is in accordance with the study by Ganesh R et al in Tamil Nadu which shows 80% of them presented with polyuria and polydipsia[10]. Four patients had abdominal pain, three had dyspnea and 2 had altered sensorium. Three patients had urinary tract infection, four patients had pneumonia and three were drug defaulters. But there were less electrolyte abnormalities compared to adults hyponatremia less than 130 mEq/L (18.1% in children vs 36.3% in adults).

Among the study population we had 100% survival rate in children.

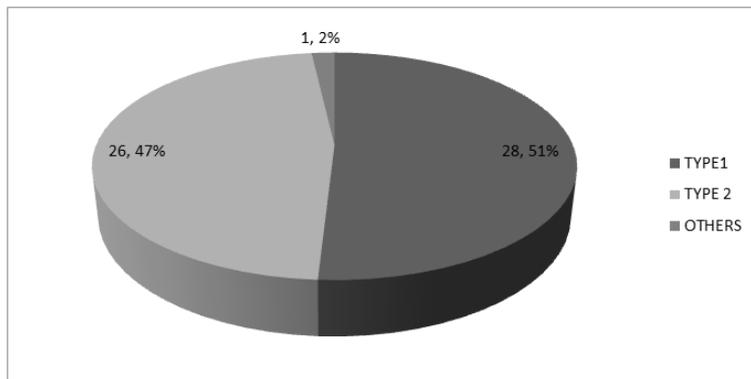


Fig-1: Pie chart showing distribution of type of diabetes

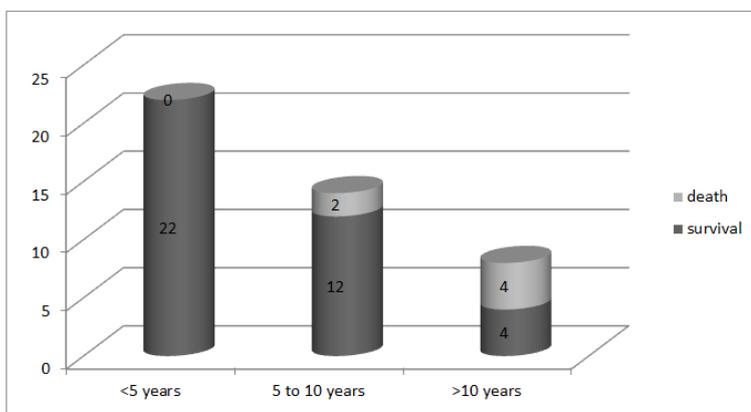


Fig-2: Bar diagram showing relation between duration of diabetes and mortality

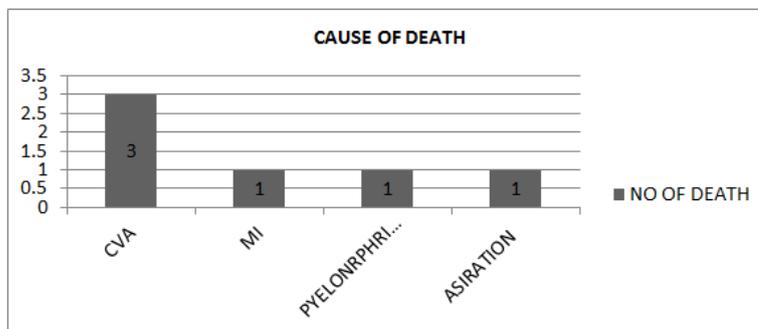


Fig-3: Bar diagram showing cause of death in adults

CONCLUSIONS

DKA was seen in both type 1 diabetes and type 2 diabetes. First presentation as DKA was more common among type 1 diabetes. DKA among adults was more common among patients in the age group of 40-60 years. Nausea, vomiting and polyuria were the most common presenting complaints. Most common precipitating factors include infections and omission of oral hypoglycemic agents or insulin. Hypokalemia was more common than hyperkalemia in the study population. Altered sensorium at presentation was an

independent predictor of mortality. Low pH, high RBS, hyponatremia, azotemia, high serum creatinine, hypophosphatemia, hypocalcemia and hypomagnesemia all were associated with increased risk of mortality. Diabetic nephropathy increases the mortality risk. Children with DKA developed less number of complications compared to adults in my study.

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