

FREQUENCY OF DIABETIC KETOACIDOSIS IN DIABETIC PATIENTS

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ABSTRACT

Objective

To determine the frequency of diabetic ketoacidosis in diabetic patients.

Study design

Cross sectional study

Place and duration of study

Department of medicine DHQ Hospital and Aziz Fatimah Hospital, Faisalabad from July 2010 to December 2010.

Materials and methods

One hundred and forty diabetic patients of either sex and age more than 15 years with fasting plasma glucose level 126 mg/dL or higher on more than one occasion were included in study. Random plasma glucose, arterial blood gases and urine ketones were done to diagnose diabetic ketoacidosis. Patients with stroke, and hepatic and uremic encephalopathy were excluded. Quantitative variables like age, plasma glucose levels, blood pH and serum bicarbonate were recorded as mean and standard deviation. Qualitative variables like sex and urine ketones were recorded as frequency and percentage.

Results

The mean age of the patients was 50.8±14.3 years. There were 54(38.6%) male and 86(61.4%) female patients. Mean fasting plasma sugar was 211±60.9 mg/dL and 208±50.6 mg/dL on two different occasions. Mean random plasma glucose was 337.1±79 mg/dL. There were 20 (14.3%) patients whose urine for ketones was positive, and their blood pH was <7.3 and serum bicarbonate was <15 mEq/L. So diabetic ketoacidosis was found in 20 (14.3%) patients and 120 (85.7%) patients did not have diabetic ketoacidosis.

Conclusion

It is concluded from this study that diabetic ketoacidosis is common in patients with diabetes mellitus occurring in 14.3% of all cases.

Keywords: Diabetes mellitus, diabetic ketoacidosis, fasting plasma glucose, random plasma glucose.

INTRODUCTION

Diabetes mellitus is a syndrome with disordered metabolism and inappropriate hyperglycemia due to either a deficiency of insulin secretion or to a combination of insulin

resistance and inadequate insulin secretion to compensate.¹ The prevalence of diabetes mellitus for all age groups worldwide was estimated to be 2.8% in year 2000 but it will increase to 4.4% by the year 2030.² No accurate figures for the prevalence of diabetes mellitus in Pakistan are available but according to several small scale studies conducted in different parts of the country prevalence of diabetes mellitus vary from 5.3% to 16.2%.³ The prevalence of diabetes mellitus has increased dramatically in the past

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two decades. It is estimated that the number of diabetic patients will grow from 135 million to 300 million by year 2025 in the world. Unfortunately the major increase will occur in developing countries, and in Pakistan the number of diabetic patients in the year 2025 is estimated to be doubled. In Pakistan approximately 8 million people have diabetes mellitus and the same number is suffering from impaired glucose tolerance.⁴

Diabetic ketoacidosis and hyperosmolar non ketotic coma are the most common acute complications of diabetes mellitus.^{5, 6} Diabetic ketoacidosis is a life threatening medical emergency with overall mortality rate which varies from 1 to 10% depending upon experience of treating center.⁷

In this study the frequency of diabetic ketoacidosis will be determined in diabetic patients presenting to medical departments of DHQ and Aziz Fatimah Hospitals, Faisalabad. The frequency of diabetic ketoacidosis in diabetic patients has not been studied much in Pakistani population. Our study will provide local data about diabetic ketoacidosis and will help to improve medical care, and decrease mortality and morbidity of patients presenting with diabetic ketoacidosis.

Operational definitions

Diabetic ketoacidosis is biochemically defined as a venous pH < 7.3 or serum bicarbonate concentration < 15 mmol/L, serum glucose concentration > 200 mg/dL together with ketonemia, glucosuria, and ketonuria⁸. Diabetes mellitus is defined as fasting plasma glucose level 126 mg/dL or higher on more than one occasion.¹

MATERIALS AND METHODS

This study was conducted in the departments of medicine at DHQ and Aziz Fatimah Hospitals, Faisalabad.

Inclusion criteria

All patients of either sex, and age more than 15 years with fasting plasma glucose level 126 mg/dL or higher on more than one occasion were included in the study.

Exclusion criteria

1. Random plasma glucose more than 600 mg/dL
2. Serum osmolality more than 310 mosm/kg.

3. Patients with stroke

4. Patients with hepatic and uremic encephalopathy

One hundred and forty diabetic patients fulfilling the inclusion criteria were selected from DHQ and Aziz Fatimah Hospitals, Faisalabad. The purpose of study was explained to each patient or attendant, and informed consent was obtained. The history of each patient was recorded and physical examination was done. Patients having random plasma glucose more than 600 mg/dL and plasma osmolality more than 310 mosm/kg were excluded from the study to rule out hyperosmolar non ketotic state. Arterial blood gases, serum electrolytes and urine ketones were done in each patient.

Performa was developed to record history, physical examination and biochemical findings of all patients. The collected data was analyzed and the quantitative variables of the study like age, plasma glucose levels, blood pH and serum bicarbonate level were recorded as mean and standard deviation. The qualitative variables like sex and diabetic ketoacidosis were recorded as frequency and percentage.

RESULTS

One hundred and forty patients of diabetes mellitus who fulfilled the inclusion criteria were included in the study. The mean age of the patients was 50.8±14.3 years. There were 10 (7.1%) patients of age range of 20-30 years, 20 (14.3%) patients of age range of 31-40 years, 43 (30.7%) patients of age range of 41-50 years, 42 (30%) patients of age range of 51-60 years, 18 (12.9%) patients of age range of 61-70 years and 7 (5%) patients of age range of 71-80 years (Fig. 1).

There were 54 (38.6%) male patients and 86 (61.4%) female patients (Table 1). The mean fasting plasma glucose (1) was 211±60.9 mg/dL. There were 71 (50.7%) patients of plasma glucose range of 130-200 mg/dL, 53 (37.9%) patients of plasma glucose range of 201-300 mg/dL and 16 (11.4%) patients of plasma glucose range of 301-400 mg/dL (Fig. 2). The mean fasting plasma glucose (2) was 208±50.6 mg/dL. There were 70 (50%) patients of plasma glucose range of 130-200 mg/dL, 63 (45%) patients of the plasma glucose range of 201-300 mg/dL and 7 (5%) patients of plasma glucose range of 301-400 mg/dL (Fig. 3).

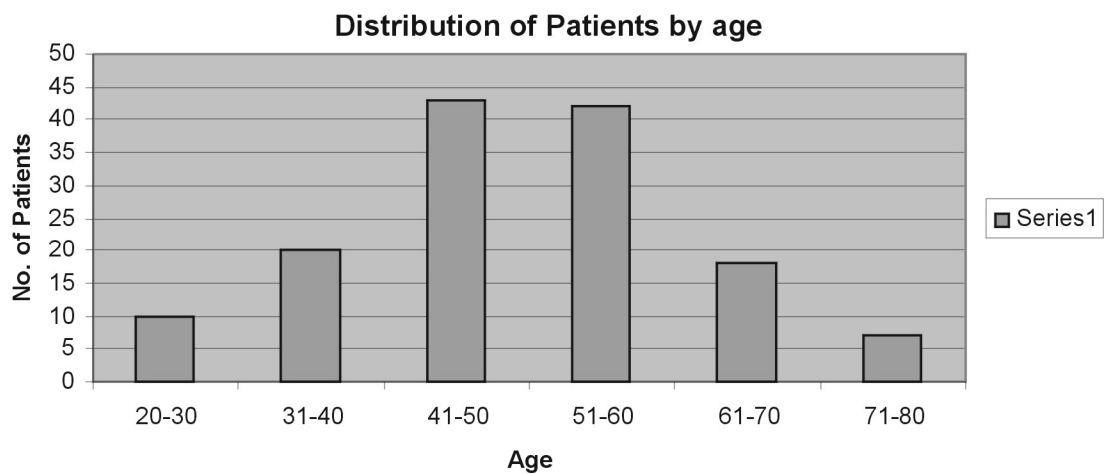


Figure 1. Mean \pm SD 50.8 \pm 14.3

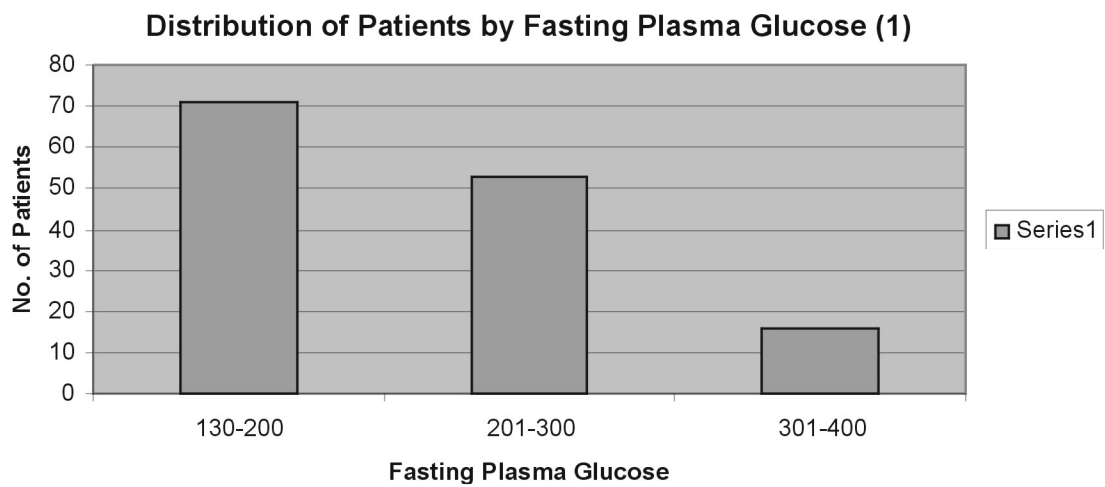


Figure 2. Mean \pm SD 211 \pm 60.9

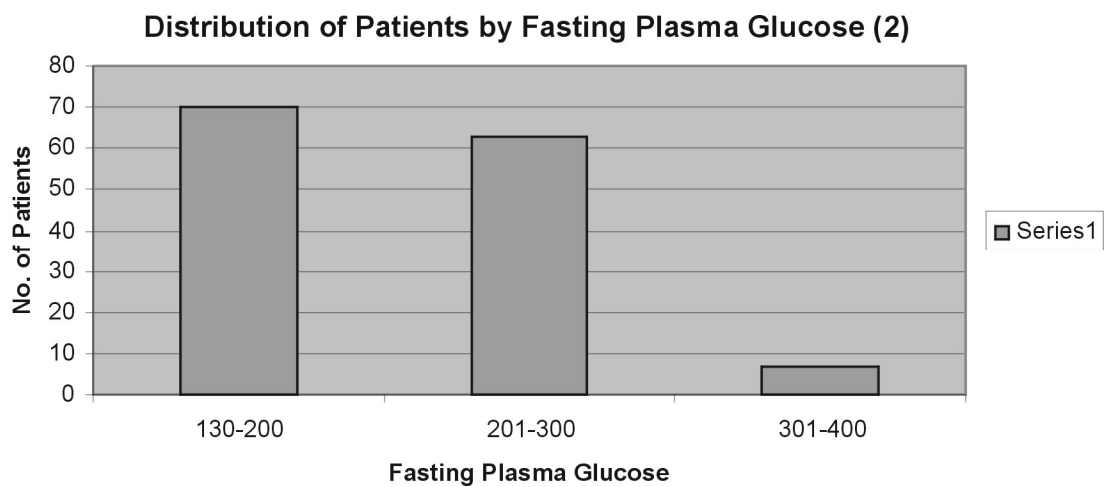


Figure 3. Mean \pm SD 208.2 \pm 50.6

Table 1. Distribution of Patients by Sex (n=140)

Sex	No. of Patients	Percentage
Male	54	38.6
Female	86	61.4
Total	140	100

The mean random plasma glucose was 337.1 ± 79 mg/dL. There were 3 (2.1%) patients of plasma glucose range of 160-200 mg/dL, 45 (32.2%) patients of plasma glucose range of 201-300 mg/dL, 57 (40.7%) patients of plasma glucose range of 301-400 mg/dL and 35 (25%) patients of plasma glucose range of 401-500 mg/dL (Fig. 4).

There were 20 (14.3%) patients in whom blood pH was <7.3 and 120 (85.7%) patients in whom blood pH was ≥ 7.3 (Table 2). 20 (14.3%) patients had serum bicarbonate <15

mEq/L and 120 (85.7%) patients had serum bicarbonate ≥ 15 mEq/L (Table 3). So there were 20 (14.3%) patients who had diabetic ketoacidosis and 120 (85.7%) patients were not having diabetic ketoacidosis (Fig. 5).

Table 2. Distribution of Patients by blood pH (n=140)

Blood pH	No. of Patients	Percentage
< 7.3	20	14.3
> 7.3	120	85.7
Mean \pm SD	7.4 ± 0.05	

Table 3. Distribution of Patients by serum bicarbonate (n=140)

Blood pH	No. of Patients	Percentage
< 15	20	14.3
≥ 15	120	85.7
Mean \pm SD	21.3 ± 4.1	

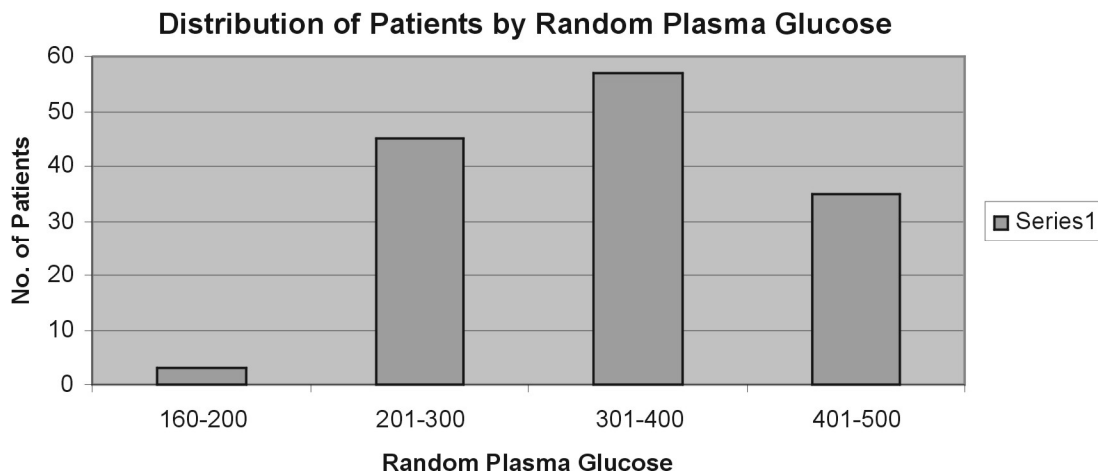
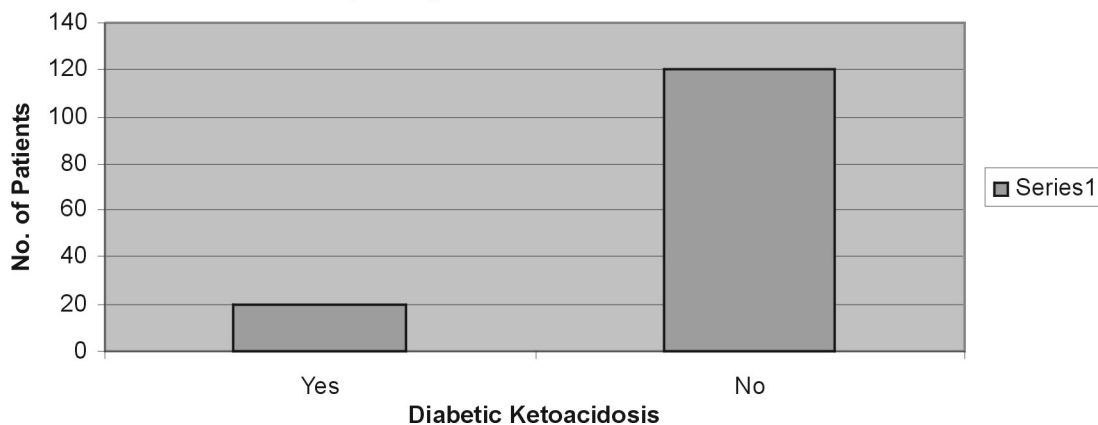


Figure 4. Mean \pm SD 337.1 ± 79
Frequency of Diabetic Ketoacidosis

**Figure 5.**

DISCUSSION

Diabetic ketoacidosis is the most common hyperglycemic emergency in patients with diabetes mellitus.^{5, 6} It is a life threatening condition with mortality rate less than 5% in experienced centers whereas overall mortality may be up to 10%.⁷ DKA tends to occur in individuals younger than 19 years in type 1 diabetes mellitus whereas it may occur in diabetes of any age.⁸ The cardinal biochemical features of DKA are hyperglycemia more than 200 mg/dL, blood pH less than 7.3, serum bicarbonate less than 15 mEq/L and hyperketonemia. In the absence of insulin, tissues like muscles, fat and liver do not take up glucose, and counter regulatory hormones such as glucagon, growth hormone and catecholamines enhance triglyceride breakdown into free fatty acids, and increased gluconeogenesis is the main cause of hyperglycemia. Beta oxidation of free fatty acids leads to increased formation of ketone bodies.⁹

Nausea and vomiting are often prominent in DKA and their presence in diabetic's warrants laboratory evaluation. Abdominal pain may be severe and can resemble with ruptured viscus and acute pancreatitis. Hyperglycemia leads to glucosuria, volume depletion, tachycardia and hypotension. Kussmaul's breathing and fruity odour are classic signs of this disorder. Lethargy and central nervous system depression may evolve into coma in severe DKA. Cerebral edema and ischemic stroke are extremely serious complications of DKA.^{5, 10}

In our study the mean age of the patients was 50.8±14.3 years with the age range of 20 to 80 years. In a study by Pinto *et al.* the mean age of the patients was 45±12 years, which is comparable with our study.¹¹ In our study there were 38.6% male patients and 61.4% female patients which is comparable with the study by Habib¹² in which there were 41% male patients and 59% female patients. In our study the 14.3% patients has blood pH <7.3 and 85.7% patients has blood pH ≥7.3 and there were 14.3% patients with serum bicarbonate <15 mEq/L and 85.7% patients with serum bicarbonate ≥15 mEq/L.

So in our study 20 (14.3%) patients had diabetic ketoacidosis and 120 (85.7%) patients were not in diabetic ketoacidosis. This is comparable with the study of Pitteloud and Philippe in which frequency of diabetic ketoacidosis was 16%.¹³ Pitteloud and Philippe analyzed that DKA is more common than previously thought in patients with type 2 diabetes mellitus.¹³ In another study by Hekkala *et al.* the frequency of DKA was 15.2% in diabetic patients which is comparable to 14.3% as shown by our study.¹⁴ Prevention of DKA and reduction of its frequency should be a goal in managing patients of diabetes mellitus. Increasing standards of medical and general awareness among diabetic patients can contribute to this.¹²

CONCLUSION

It is concluded from this study that diabetic ketoacidosis is common in patients with diabetes mellitus occurring in 14.3% of all cases. Moreover diabetic ketoacidosis can occur in type 2 diabetes mellitus.

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