

CLINICAL FEATURES OF DIABETIC KETO ACIDOSIS INDIVIDUALS IN THE INTENSIVE CARE UNIT

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ABSTRACT

Background: Diabetic ketoacidosis (DKA) is the most common acute hyperglycemic condition related to diabetes. Recent investigations suggest that DKA affects approximately 8 out of every 1,000 diabetics annually. **Objective:** This study aims to determine the clinical features of individuals with severe DKA admitted to ICU. **Study Design:** A retrospective analysis. **Setting:** The study was conducted at Bahria International Hospital Lahore and Services Institute of Medical Sciences Lahore, Pakistan. **Duration of Study:** The study period was from Oct 01, 2022, to March 30, 2023. **Methods:** Data from patients' health records were retrospectively analysed, including demographics, clinical manifestations (fever, nausea, vomiting, abdominal pain, breathlessness, altered sensorium, low blood pressure), and triggering factors (insulin discontinuation, septicemia). Hospital stay duration, mortality rate, and usage of mechanical ventilation were also documented. **Results:** A total of 30 patients were enrolled in the study, of whom 26 (86.6%) were males. The most prevalent complaint was abdominal discomfort, observed in 86.6% of the study population. Vomiting was present in 93.3% of the individuals. Only 8 (26.6%) patients were newly diagnosed with diabetes, while the remainder were known type 1 diabetics on insulin treatment. The mean HbA1c was 10.2%, ranging from 8.7% to 12.6%. Serum blood glucose, bicarbonate levels, and anion gap were independently associated with clinical indicators of severe DKA. A correlation was found between DKA indicators and the requirement for mechanical ventilation. **Conclusion:** The majority of individuals with severe DKA admitted to our ICU experienced gastrointestinal symptoms, with noncompliance to insulin treatment being the primary cause of DKA.

Keywords: Abdominal Pain, Diabetic Ketoacidosis, Hyperglycemia, Intensive Care Units, Insulin, Type 1 Diabetes

INTRODUCTION

Diabetic ketoacidosis (DKA) is the leading acute hyperglycemic illness associated with diabetes. A new analysis indicates that DKA affects around 8 of every 1000 diabetics yearly (1). It causes severe mortality and morbidity (2) with a global fatality rate of 2-10% (3). Diabetic ketoacidosis is characterised by high blood sugar levels, metabolic acidosis and ketonuria (4). This is the most severe acute metabolic complication of diabetes mellitus (5).

DKA is now diagnosed and classified using blood sugar levels, arterial pH, serum bicarbonate, anion gap, and cognitive changes (6). DKA is mainly caused by a lack of insulin as well as by infection, particularly in underdeveloped nations (7).

Patients who received adequate therapy, including insulin injection, electrolytes adjustment, and triggering factor management, had a decreased mortality rate (8).

This study aimed to outline the clinical features of individuals with severe DKA admitted to the Intensive Care Units of Bahria International Hospital Lahore and Services Institute of Medical Sciences, Lahore, as well as examine the correlation between paraclinical (blood sugar, anion gap, and the serum bicarbonate) and clinical indicators.

METHODOLOGY

A retrospective analysis was conducted on individuals with DKA hospitalised in the Intensive Care Units of Bahria International Hospital Lahore and Services Institute of Medical Sciences, Lahore, between Oct 01, 2022, and March 30, 2023. The hospital's ethical committee approved this study, and the institutional review board gave its approval for this study to be conducted.

The inclusion requirements were critically sick patients over 13 years old with an established diagnosis of DKA (5). The emergency department specialist chose to admit people who had DKA to the ICU. Individuals having hyperosmolar hyperglycemic states weren't included in the research.

The data collected from patients' medical records comprised demographics, clinical symptoms (e.g., fever, nausea, vomiting, abdominal pain, breathlessness, altered sensorium, low blood pressure), and triggering factors (e.g., insulin discontinuation and septicemia, as defined by the Society of Critical Care Medicine). We recorded the length of hospital stay, mortality rate, and use of mechanical ventilation.

We evaluated the plasma glucose level, serum bicarbonate levels, and anion gap measurements to assess the degree of severity of DKA. The anion gap was determined using the equation $[(Na^+) - (Cl^-) + HCO_3^-]$ (mEq/L). We also assessed the severity of DKA utilising the patient's degree of cognition (drowsiness, stupor, or coma) and the necessity for mechanical ventilation.

For continuous data, patient features were described using proportions for binary variables and median (with inter-quartile range). Regression analysis was used to investigate the relationship between DKA indicators and outcome factors, sensorium changes, and the necessity for mechanical ventilation. Multiple logistic regressions were applied to adjust for confounding factors such as age, gender, and infection status. To determine statistical significance, a confidence interval of 95% was established. Each analysis was carried out using SPSS version 21. The results are frequency (percentage) and mean \pm standard deviation. A p value of less than 0.05 was deemed significant.

RESULTS

A total of 30 patients who fulfilled our inclusion criteria were enrolled in our study. The study population's median age was 24, and the range was 18-30. Among these, 26 (86.6%) were males.

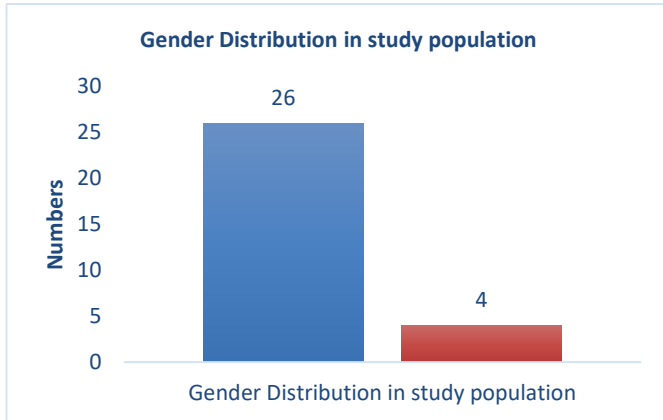


Figure 1 shows the Gender distribution in the study population.

Fever was present in 33.3% of the study population. The most prevalent complaint was abdominal discomfort. Abdominal pain presentation accounted for up to 86.6% of the study population. Vomiting was present in 93.3% of the individuals. Other features of the patients and their associated frequency are shown in Table 1.

Table 1: Patients clinical features

Variable	Number n=30	Percentage
Age	18-30 years, median age 24 years	
Fever	10	33.3
Abdominal pain	26	86.6
Vomiting	28	93.3
Dyspnea	8	26.6
Low blood pressure	4	13.3
Altered sensorium	11	36.6
Stoppage of insulin treatment	27	90
Infection	12	40
Need for mechanical ventilation	7	23.3
Mean HbA1c	10.2%	

The major precipitating factor for the onset of DKA was the stoppage of insulin dose. 90% of the individuals mentioned that they had stopped taking their regular dose of insulin. Sepsis was present in 40% of the individuals (Table 1). The average ICU stay duration remained 2.8 days (range: 1-3). There were no deaths in the present study.

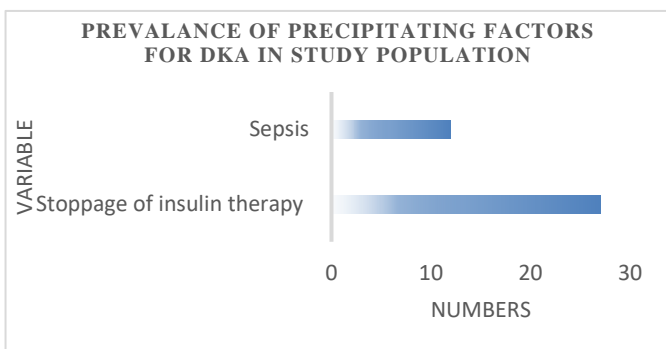


Figure 2 shows the prevalence of precipitating factor for DKA in the study population

Only 8(26.6%) of the patients were newly identified as diabetics, while the rest were known patients of type 1 diabetes treated with insulin. The mean HbA1c was 10.2%, ranging from 8.7% to 12.6%.

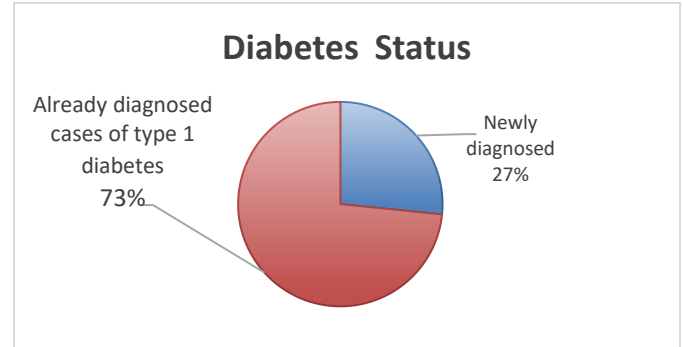


Figure 3 Shows the Diabetes status in the study population

Table 2: Correlation across diabetic ketoacidosis factors and altered sensorium in the study population.

Variable	Crude OR (95% CI)
Plasma glucose level	1.01 (0.95 – 1.07)
Serum bicarbonate	1.03 (0.96 – 1.12)
Measured anion gap	0.99 (0.92 – 1.04)

Serum blood glucose, bicarbonate level, and anion gap were all independently associated with clinical indicators of severe DKA (Table 2).

Table 3: Correlation among diabetic ketoacidosis indicators and the necessity for mechanical ventilation in the study population.

Variable	Crude OR (95% CI)	Adjusted* OR (95% CI)
Plasma glucose level	1.02 (0.95 – 1.09)	1.02 (0.96 – 1.09)
Serum bicarbonate	1.01 (0.92 – 1.11)	1.0 (0.91 – 1.11)
Measured anion gap	1.03 (0.97 – 1.09)	1.06 (0.99 – 1.13)

* Adjusted for age, gender, and sepsis status.

The study found a correlation between indicators of DKA and the requirement for mechanical ventilation in the study population (Table 3)..

DISCUSSION

The present retrospective research examined the clinical features of individuals having severe DKA hospitalised in the ICUs at Bahria Hospital & Services Institute of Medical Sciences in the study period. At admission, more than half of our patients experienced gastrointestinal symptoms (vomiting and intestinal discomfort), whereas one-third had impaired consciousness or feeling dizzy. Other writers have reported that gastrointestinal manifestations and altered sensorium are the most prevalent indicators of DKA. (9). However, our analysis found a greater prevalence of gastrointestinal complaints than the authors claimed. (1). This discrepancy may be due to variations in the characteristics of the sample.

Our sample comprised eight (26.6%) newly identified type 1 diabetes experiencing DKA as their first manifestation, compared to just 18.2% in Babar et al.'s research (10). Diagnostic criteria for DKA include plasma glucose levels above 250 mg/dL, arterial pH below 7.3, and ketonuria. (5).

Retrospective research found that severe DKA is characterised by impaired sensorium and the necessity for mechanical ventilation. (11). Our investigation found that an altered mental state predicts DKA severity. These results are in line with the findings of the previous

researchers. (12). The contributing factors of impaired mental state in DKA remain unknown. Still, they may include impaired blood flow to the brain, decreased glucose usage, hyperosmolarity, high blood glucose levels, acidosis, or a direct influence of ketone bodies, which are proposed hypotheses. (13, 14).

Mechanical ventilation is an essential indicator of severe DKA in our research. Sepsis may have contributed to this. The standards of diagnosis for sepsis followed the 2022 Sepsis Definition, which includes an altered mental state suggesting global hypoperfusion. (15). Tissue hypo perfusion contributes to multi-organ failure, indicating the necessity for artificial ventilation. (16).

Previous research has shown infection as the leading cause of DKA.(17).

Other documented triggering parameters include discontinuing or insufficient insulin medication, cerebrovascular accidents, cardiovascular illnesses, and medications. (18).New-onset type 1 diabetes or insulin discontinuation in existing type 1 diabetes often leads to DKA (19).

Our investigation found that insulin discontinuation, whether intentional or unintentional, was the leading cause of DKA. To prevent DKA, we recommend educating those with diabetes and their families on the significance of optimum insulin use, eating habits modification, psychological assistance, and evaluating glycemic control. Individuals may not adhere to treatment due to financial barriers, lack of insulin availability, or other reasons.

Our study group experienced no reported fatalities, indicating positive patient outcomes.DKA mortality rate ranges between 1-5% in previous research (12).In DKA, mortality is mainly caused by the underlying triggering illness, rather than by the metabolic consequences of acidosis (20).

Our study includes limitations that should be considered. The study is limited by its retrospective nature. Second, the limited sample size reduces the research's statistical significance. finally, we lacked information on our participants' long-term outcomes following ICU discharge.

CONCLUSION

The majority of those with DKA referred to our ICU had gastrointestinal complaints. Failure to comply with insulin medication was the primary cause in these individuals, highlighting a significant gap in health care delivery. Patient-centered approaches to optimize health services and education availability may assist noncompliant individuals. A multi modal program can relieve the monetary and logistical burden of managing DKA, benefiting less privileged individuals in the medical system. This project should promote insulin therapy compliance by supplying medicine, follow up services, and counseling to underprivileged individuals without health insurance or adequate incomes.

DECLARATIONS

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declared absence of conflict of interest.

AUTHOR CONTRIBUTION

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Study Design, Review of Literature.

Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.

RIZWAN PERVAIZ

Conception of Study, Final approval of manuscript.

MUHAMMAD JAVED

Data entry and Data analysis, drafting article.

Coordination of collaborative efforts.

MUHAMMAD BURHAN ATTA

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SITARA RAZA

Manuscript revisions, critical input.

ADEEL

Conception of Study, Development of Research Methodology Design,

Study Design,, Review of manuscript, final approval of manuscript.

ARISH ASGHAR

Study Design, Review of Literature.

Manuscript revisions, critical input.

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