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A Prospective Observational Study on the Clinical Profile, Risk Factors, Management Practices, and Outcomes of Children Admitted with Type 1 Diabetes Mellitus and Diabetic Ketoacidosis

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ABSTRACT

Background: Diabetic ketoacidosis (DKA) is the most common life-threatening acute complication of Type 1 Diabetes Mellitus (T1DM) in children and remains a major cause of morbidity and mortality, particularly in developing countries. Early recognition of risk factors and standardized management are essential for improving outcomes.

Objectives: To evaluate the clinical profile, risk factors, management practices, and outcomes of children admitted with Type 1 Diabetes Mellitus presenting with diabetic ketoacidosis.

Materials and Methods: This prospective observational study was conducted in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, from January 2025 to June 2026. Sixty children aged 1–18 years with T1DM and DKA diagnosed according to ISPAD criteria were enrolled using consecutive sampling. Demographic characteristics, clinical presentation, precipitating factors, laboratory parameters, management practices, complications, and clinical outcomes were recorded using a structured proforma. Patients were managed according to the ISPAD pediatric DKA protocol. Data were analyzed using IBM SPSS Statistics version 26.0, and a p-value <0.05 was considered statistically significant.

Results: The mean age of the study population was 9.8 ± 3.7 years, and females constituted 53.3% of cases. Newly diagnosed T1DM accounted for 56.7% of admissions. Polyuria (93.3%), polydipsia (90.0%), weight loss (76.7%), vomiting (70.0%), dehydration (100%), and Kussmaul respiration (53.3%) were the most frequent clinical features. Poor glycemic control (HbA1c >9%) (68.3%), newly diagnosed diabetes (56.7%), missed insulin doses (33.3%), poor treatment compliance (30.0%), and respiratory infections (26.7%) were the predominant risk factors. Moderate DKA was observed in 43.3% of patients, while 26.7% had severe DKA. The mean random blood glucose was 458.4 ± 118.6 mg/dL, mean venous pH was 7.15 ± 0.11, and mean serum bicarbonate was 8.6 ± 3.5 mmol/L. All children received intravenous insulin infusion, and 40.0% required PICU admission. The mean time to DKA resolution was 17.9 ± 5.8 hours, and the mean hospital stay was 5.4 ± 2.1 days. Hypokalemia (16.7%) was the most common complication, followed by hypoglycemia (10.0%), acute kidney injury (6.7%), and cerebral edema (3.3%). Severe DKA was significantly associated with longer hospital stay and higher PICU admission (p<0.001). Overall, 95.0% of children recovered completely, with a mortality rate of 1.7%.

Conclusion: Diabetic ketoacidosis remains a significant cause of pediatric hospitalization in children with Type 1 Diabetes Mellitus. Newly diagnosed diabetes, poor glycemic control, missed insulin doses, and infections were the major precipitating factors. Early diagnosis, prompt implementation of standardized

ISPAD-based management, regular diabetes education, and improved treatment adherence are essential for reducing complications, shortening hospital stay, and improving survival.

Keywords: *Type 1 diabetes mellitus, diabetic ketoacidosis, children, pediatric diabetes, risk factors, clinical profile, management, outcomes.*

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is one of the most common chronic endocrine disorders affecting children and adolescents worldwide. It results from autoimmune destruction of pancreatic β-cells, leading to absolute insulin deficiency and lifelong dependence on exogenous insulin therapy. The global incidence of T1DM has steadily increased over the past two decades, particularly in developing countries, with an annual rise of approximately 3–4%. India is among the countries with the largest number of children living with T1DM, posing a significant public health challenge due to delayed diagnosis, inadequate awareness, limited healthcare access, and socioeconomic disparities (1,2).

Diabetic ketoacidosis (DKA) is the most serious acute complication of T1DM and remains the leading cause of morbidity and mortality among children with diabetes. DKA develops due to absolute or relative insulin deficiency accompanied by increased secretion of counter-regulatory hormones, including glucagon, cortisol, catecholamines, and growth hormone. This metabolic imbalance results in hyperglycemia, ketosis, dehydration, electrolyte disturbances, and metabolic acidosis. Without prompt recognition and appropriate treatment, DKA may progress to cerebral edema, circulatory collapse, multiple organ dysfunction, and death (3,4).

Despite advances in diabetes care, DKA continues to be the presenting manifestation of T1DM in approximately 20–50% of newly diagnosed children worldwide. The incidence is even higher in low- and middle-income countries because of delayed diagnosis, poor awareness among caregivers, and limited availability of specialized pediatric diabetes services. In children with previously diagnosed T1DM, recurrent episodes of DKA are frequently associated with poor insulin adherence, inadequate diabetes education, psychosocial issues, infections, and socioeconomic barriers (5,6).

The clinical presentation of DKA varies according to disease severity. Classical symptoms include polyuria, polydipsia, polyphagia, weight loss, vomiting, abdominal pain, dehydration, Kussmaul respiration, acetone breath, altered sensorium, and varying degrees of shock. Laboratory abnormalities include marked hyperglycemia, metabolic acidosis, ketonemia or ketonuria, elevated anion gap, electrolyte disturbances, and dehydration. Early recognition of these manifestations is essential to prevent life-threatening complications (7).

International Society for Pediatric and Adolescent Diabetes (ISPAD) guidelines recommend standardized management of pediatric DKA using careful fluid replacement, continuous intravenous insulin infusion, electrolyte correction, and close neurological monitoring. Appropriate management has substantially reduced mortality to below 1% in developed countries. However, mortality remains considerably higher in resource-limited settings due to delayed presentation, inadequate monitoring, and complications such as cerebral edema and acute kidney injury (3,8).

Several studies have identified newly diagnosed diabetes, missed insulin doses, poor glycemic control, respiratory and gastrointestinal infections, psychological stress, and socioeconomic constraints as important precipitating factors for DKA. Understanding these modifiable risk factors is essential for developing preventive strategies aimed at reducing hospital admissions and recurrent DKA episodes (9,10).

Recent evidence also highlights the importance of structured diabetes education, multidisciplinary follow-up, and family-centered care in preventing recurrent DKA and improving long-term metabolic control. Continuous glucose monitoring, insulin pump therapy, and early referral to pediatric diabetes clinics have significantly improved outcomes in many regions; however, these interventions remain inaccessible to many children in developing countries (11).

There remains limited prospective data from India evaluating the clinical profile, precipitating factors, management practices, and outcomes of pediatric DKA in tertiary care settings. Regional differences in healthcare infrastructure, nutritional status, socioeconomic conditions, and healthcare-seeking behavior may influence disease presentation and outcomes. Therefore, this prospective observational study was undertaken to evaluate the clinical characteristics, risk factors, management practices, and treatment outcomes among children admitted with Type 1 Diabetes Mellitus and diabetic ketoacidosis at ESIC Medical College and Hospital, Kalaburagi. The findings are expected to contribute to improved early diagnosis, evidence-based management, and preventive strategies for pediatric DKA (12).

MATERIALS AND METHODS

Study Design

This was a prospective, hospital-based observational study conducted to evaluate the clinical profile, risk factors, management practices, and outcomes of children admitted with Type 1 Diabetes Mellitus (T1DM) presenting with Diabetic Ketoacidosis (DKA).

Study Setting

The study was carried out in the Department of Pediatrics, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India, over a period of 18 months from January 2025 to June 2026. All eligible children admitted to the Pediatric Ward and Pediatric Intensive Care Unit (PICU) during the study period were screened for enrollment.

Study Population

Children diagnosed with Type 1 Diabetes Mellitus who fulfilled the diagnostic criteria for diabetic ketoacidosis at admission were included consecutively until the required sample size was achieved.

Sample Size

A total of 60 children were enrolled in the study using consecutive sampling.

Diagnostic Criteria

Diagnosis of Type 1 Diabetes Mellitus

Type 1 diabetes mellitus was diagnosed according to the American Diabetes Association (ADA) 2025 criteria based on any one of the following:

- Fasting plasma glucose ≥126 mg/dL (7.0 mmol/L).
- Random plasma glucose ≥200 mg/dL (11.1 mmol/L) in the presence of classic symptoms of hyperglycemia.
- Two-hour plasma glucose ≥200 mg/dL during an oral glucose tolerance test (where applicable).
- HbA1c ≥6.5% using an NGSP-certified assay.

Children with classical clinical features requiring lifelong insulin therapy were considered as Type 1 Diabetes Mellitus.

Diagnosis of Diabetic Ketoacidosis

Diabetic ketoacidosis was diagnosed according to the International Society for Pediatric and Adolescent Diabetes (ISPAD) 2022/2024 criteria:

- Blood glucose >200 mg/dL (11 mmol/L)
- Venous pH <7.30 or serum bicarbonate <15 mmol/L
- Presence of ketonemia (β-hydroxybutyrate ≥3 mmol/L) or moderate to large ketonuria.

Severity of DKA

Mild DKA

- pH 7.20–7.29
- Serum bicarbonate 10–15 mmol/L

Moderate DKA

- pH 7.10–7.19
- Serum bicarbonate 5–9.9 mmol/L

Severe DKA

- pH <7.10
- Serum bicarbonate <5 mmol/L

Inclusion Criteria

Children fulfilling all of the following criteria were included:

- Age between 1 and 18 years.
- Newly diagnosed or previously known Type 1 Diabetes Mellitus.
- Admission with diabetic ketoacidosis according to ISPAD criteria.
- Parents or legal guardians willing to provide written informed consent.

Exclusion Criteria

Children were excluded if they had:

- Type 2 diabetes mellitus.
- Neonatal diabetes mellitus.

- Maturity-Onset Diabetes of the Young (MODY).
- Secondary diabetes due to pancreatic disorders, endocrine diseases, drugs, or genetic syndromes.
- Hyperosmolar hyperglycemic state without ketoacidosis.
- Inborn errors of metabolism presenting with metabolic acidosis.
- Chronic kidney disease stage IV or V.
- Incomplete clinical records or refusal to participate.

Study Procedure

After obtaining informed written consent, all eligible patients underwent detailed clinical evaluation at admission. A structured pretested proforma was used for data collection.

Baseline Demographic Characteristics

The following variables were recorded:

- Age
- Sex
- Residence (Urban/Rural)
- Socioeconomic status (Modified Kuppuswamy Scale)
- Parental education
- Family history of diabetes mellitus
- Family history of autoimmune disorders
- Known or newly diagnosed Type 1 Diabetes Mellitus

Clinical Profile

Clinical history included:

- Duration of symptoms
- Polyuria
- Polydipsia
- Polyphagia
- Weight loss
- Fever
- Vomiting
- Abdominal pain
- Breathlessness
- Altered sensorium
- Seizures
- Headache
- Blurring of vision
- Decreased oral intake
- Previous episodes of DKA
- Insulin omission
- Recent infection
- Drug history

Physical Examination

A complete systemic examination was performed.

General examination included:

- Temperature
- Heart rate
- Respiratory rate
- Blood pressure
- Oxygen saturation
- Capillary refill time
- Weight
- Height
- Body Mass Index (BMI)
- Mid-upper arm circumference (where applicable)
- Hydration status
- Degree of dehydration

- Kussmaul respiration
- Acetone breath
- Glasgow Coma Scale (GCS)

Systemic examination included:
- Respiratory system
- Cardiovascular system
- Abdomen
- Central nervous system

Risk Factors Evaluated
Potential precipitating factors for diabetic ketoacidosis were documented.
These included:
- First presentation of Type 1 Diabetes Mellitus
- Poor insulin compliance
- Missed insulin doses
- Respiratory tract infection
- Urinary tract infection
- Gastroenteritis
- Skin and soft tissue infection
- Psychological stress
- Trauma
- Surgery
- Puberty
- Poor glycemic control (HbA1c)
- Lack of diabetes education
- Socioeconomic constraints
- Delayed referral
- Previous recurrent DKA

Laboratory Investigations
All investigations were performed in the Central Clinical Laboratory of ESIC Medical College.
Hematological Investigations
- Complete blood count
- Hemoglobin
- Total leukocyte count
- Differential leukocyte count
- Platelet count
- Hematocrit

Biochemical Investigations
- Random blood glucose
- Fasting blood glucose (after stabilization)
- HbA1c
- Blood urea
- Serum creatinine
- Serum sodium
- Serum potassium
- Serum chloride
- Serum calcium
- Serum phosphate
- Serum magnesium
- Liver function tests
- Serum osmolality

Acid–Base Assessment
- Venous blood gas analysis
- pH

- Bicarbonate
- Base excess
- Anion gap

Anion gap was calculated using:
$Na^+ - (Cl^- + HCO_3^-)$

Ketone Assessment
- Urine ketone by dipstick
- Blood β-hydroxybutyrate (where available)

Infection Work-up
Whenever clinically indicated:
- Blood culture
- Urine routine microscopy
- Urine culture
- Chest X-ray
- C-reactive protein
- Procalcitonin (if indicated)

Monitoring During Hospital Stay
Patients were managed according to ISPAD pediatric DKA protocol.
Monitoring included:
- Hourly capillary blood glucose
- Hourly neurological examination
- Hourly vital signs
- Strict intake-output charting
- Serum electrolytes every 2–4 hours
- Venous blood gas every 2–4 hours
- Continuous cardiac monitoring
- Urine ketone monitoring
- Fluid balance monitoring

Management Practices Evaluated
The following treatment variables were documented:
- Time from admission to initiation of treatment
- Initial fluid bolus
- Type of intravenous fluids
- Total fluid deficit replacement
- Maintenance fluid calculation
- Insulin infusion rate
- Time to insulin initiation
- Potassium replacement
- Phosphate replacement (if administered)
- Bicarbonate administration (if indicated)
- Antibiotic usage
- PICU admission
- Mechanical ventilation
- Vasopressor requirement
- Transition to subcutaneous insulin
- Diabetes education before discharge

Outcome Measures
Primary Outcomes
- Resolution of diabetic ketoacidosis
- Time to DKA resolution (hours)
- Duration of insulin infusion
- Length of PICU stay
- Total hospital stay

- Survival at discharge

Secondary Outcomes
Complications during hospitalization:

- Hypoglycemia
- Hypokalemia
- Hyperkalemia
- Cerebral edema
- Acute kidney injury
- Shock
- Acute respiratory distress syndrome
- Need for mechanical ventilation
- Sepsis
- Recurrent DKA during admission
- Mortality

Operational Definitions
Resolution of DKA was defined as:

- Venous pH >7.30
- Serum bicarbonate ≥15 mmol/L
- Blood β-hydroxybutyrate <1 mmol/L (or negative urine ketones where β-hydroxybutyrate was unavailable)
- Patient clinically stable and able to tolerate oral feeds.

Ethical Considerations
The study protocol was reviewed and approved by the Institutional Ethics Committee, ESIC Medical College and Hospital, Kalaburagi, before initiation of the study. Written informed consent was obtained from parents or legal guardians, and assent was obtained from children older than 7 years whenever applicable. Confidentiality and anonymity of patient information were maintained throughout the study in accordance with the Declaration of Helsinki.

Statistical Analysis
Data were entered into Microsoft Excel 2021 and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range [IQR]), as appropriate, while categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Chi-square test or Fisher's exact test for categorical variables and one-way ANOVA or Kruskal–Wallis test for continuous variables. Factors associated with severe DKA and adverse outcomes were evaluated using binary logistic regression. A two-tailed p value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS
A total of 60 children with Type 1 Diabetes Mellitus (T1DM) presenting with Diabetic Ketoacidosis (DKA) were included in the study. The mean age of the study population was 9.8 ± 3.7 years (range: 2–17 years). Females constituted a slight majority (53.3%). Newly diagnosed T1DM accounted for more than half of the admissions (56.7%). Severe DKA was observed in 26.7% of children. Most patients recovered completely following standard DKA management, while complications such as hypokalemia, cerebral edema, and acute kidney injury occurred in a minority of cases.

Table 1. Baseline Demographic Characteristics (n=60)

Variable	Number	Percentage (%)
Age (years)		
<5	**8**	**13.3**
5–10	**24**	**40.0**
11–15	**21**	**35.0**
>15	**7**	**11.7**
Gender		
Male	**28**	**46.7**
Female	**32**	**53.3**
Residence		
Urban	**36**	**60.0**
Rural	**24**	**40.0**
Socioeconomic Status		
Lower	**26**	**43.3**

Middle	**28**	**46.7**
Upper	**6**	**10.0**
Type of Diabetes		
Newly diagnosed	**34**	**56.7**
Known T1DM	**26**	**43.3**

Table 2. Clinical Presentation at Admission

Clinical Feature	N	%
Polyuria	**56**	**93.3**
Polydipsia	**54**	**90.0**
Weight loss	**46**	**76.7**
Vomiting	**42**	**70.0**
Abdominal pain	**30**	**50.0**
Fever	**21**	**35.0**
Kussmaul breathing	**32**	**53.3**
Altered sensorium	**18**	**30.0**
Dehydration	**60**	**100**
Acetone breath	**38**	**63.3**

Table 3. Risk Factors for Development of DKA

Risk Factor	n	%
Newly diagnosed diabetes	**34**	**56.7**
Missed insulin doses	**20**	**33.3**
Poor treatment compliance	**18**	**30.0**
Respiratory infection	**16**	**26.7**
Gastroenteritis	**8**	**13.3**
Urinary tract infection	**5**	**8.3**
Previous DKA episode	**11**	**18.3**
Poor glycemic control (HbA1c >9%)	**41**	**68.3**

Table 4. Laboratory Parameters at Admission

Parameter	Mean ± SD
Random Blood Glucose (mg/dL)	**458.4 ± 118.6**
HbA1c (%)	**10.9 ± 2.1**
Venous pH	**7.15 ± 0.11**
Serum Bicarbonate (mmol/L)	**8.6 ± 3.5**
Serum Sodium (mEq/L)	**132.4 ± 5.8**
Serum Potassium (mEq/L)	**4.8 ± 0.9**
Blood Urea (mg/dL)	**42.5 ± 18.3**
Serum Creatinine (mg/dL)	**0.86 ± 0.28**

Table 5. Severity of Diabetic Ketoacidosis

Severity	N	%
Mild	**18**	**30.0**
Moderate	**26**	**43.3**
Severe	**16**	**26.7**

Table 6. Management Practices

Variable	n (%) / Mean ± SD
PICU admission	**24 (40.0)**
Intravenous insulin infusion	**60 (100)**
Potassium supplementation	**54 (90.0)**
Antibiotics administered	**22 (36.7)**
Mechanical ventilation	**3 (5.0)**
Mean insulin infusion duration (hours)	**19.6 ± 6.4**
Transition to SC insulin within 24 hours of DKA resolution	**57 (95.0)**

Table 7. Clinical Outcomes

Outcome	Mean ± SD / n (%)
Time to DKA resolution (hours)	17.9 ± 5.8
Hospital stay (days)	5.4 ± 2.1
PICU stay (days)	2.3 ± 1.2
Complete recovery	57 (95.0)
Mortality	1 (1.7)
Referred to higher centre	2 (3.3)

Table 8. Complications During Hospitalization

Complication	N	%
Hypokalemia	10	16.7
Hypoglycemia	6	10.0
Cerebral edema	2	3.3
Acute kidney injury	4	6.7
Shock	3	5.0
Recurrent DKA during admission	2	3.3

Table 9. Association Between DKA Severity and Hospital Stay

DKA Severity	Mean Hospital Stay (days)	p-value
Mild	3.8 ± 1.0	
Moderate	5.2 ± 1.4	
Severe	7.3 ± 2.1	<0.001

Table 10. Association Between DKA Severity and Clinical Outcome

Variable	Mild (n=18)	Moderate (n=26)	Severe (n=16)	p-value
PICU admission	2 (11.1%)	8 (30.8%)	14 (87.5%)	<0.001
Hypokalemia	1 (5.6%)	3 (11.5%)	6 (37.5%)	0.021
Cerebral edema	0	0	2 (12.5%)	0.031
Complete recovery	18 (100%)	25 (96.2%)	14 (87.5%)	0.118
Mortality	0	0	1 (6.3%)	0.081

DISCUSSION

The present prospective observational study evaluated the clinical profile, precipitating factors, management practices, and outcomes among 60 children admitted with Type 1 Diabetes Mellitus complicated by diabetic ketoacidosis. The findings demonstrate that DKA continues to be a common and potentially life-threatening presentation of childhood T1DM, particularly among newly diagnosed patients. However, timely institution of standardized ISPAD-based management resulted in favorable clinical outcomes with a high recovery rate and low mortality.

The mean age of children in the present study was 9.8 ± 3.7 years, with the majority belonging to the 5–15-year age group. Similar age distributions have been reported in previous pediatric DKA studies, where school-aged children and adolescents constitute the largest proportion of admissions because autoimmune β-cell destruction commonly becomes clinically evident during these years (5,9). Female children (53.3%) marginally outnumbered males, although gender differences in pediatric DKA have generally been inconsistent across studies and are not considered significant predictors of disease severity (6,10).

More than half of the study population (56.7%) presented with newly diagnosed Type 1 Diabetes Mellitus. Comparable observations have been reported internationally, where DKA remains the initial presentation in approximately one-third to one-half of children with newly diagnosed diabetes (3,11). Delayed recognition of classical diabetic symptoms by caregivers and primary healthcare providers continues to contribute substantially to late presentation, particularly in developing countries.

Polyuria (93.3%), polydipsia (90%), weight loss (76.7%), vomiting (70%), dehydration (100%), and Kussmaul respiration (53.3%) were the predominant presenting manifestations in the present study. These findings closely resemble those reported in ISPAD guidelines and previous observational studies, where osmotic diuresis, dehydration, ketosis, and compensatory respiratory alkalosis represent the hallmark features of pediatric DKA (3,7). Altered sensorium was observed in 30% of children, indicating significant metabolic derangement among severe cases.

Poor glycemic control (HbA1c >9%) was identified as the most frequent risk factor (68.3%), followed by newly diagnosed diabetes (56.7%), missed insulin doses (33.3%), poor treatment compliance (30%), and respiratory infections (26.7%). Similar precipitating factors have consistently been described in earlier studies. Inadequate insulin administration remains the most important preventable cause of recurrent DKA among children with established diabetes, whereas infections further increase insulin requirements through enhanced secretion of counter-regulatory hormones (6,9,10).

Laboratory findings demonstrated marked hyperglycemia (458.4 ± 118.6 mg/dL), elevated HbA1c (10.9 ± 2.1%), severe metabolic acidosis (mean pH 7.15 ± 0.11), and reduced bicarbonate concentrations (8.6 ± 3.5 mmol/L). These biochemical abnormalities are consistent with the classical metabolic disturbances described in ADA and ISPAD diagnostic criteria and correlate well with disease severity (1,3).

Moderate DKA (43.3%) represented the largest subgroup, while severe DKA accounted for 26.7% of admissions. Similar proportions have been reported in several tertiary-care pediatric centers. The relatively high frequency of severe DKA likely reflects delayed referral and inadequate recognition of early diabetic symptoms before hospitalization (5,8).

All patients received intravenous insulin infusion according to standard ISPAD recommendations, while 90% required potassium supplementation because insulin therapy and correction of acidosis promote intracellular potassium shift. Nearly 40% required PICU admission, reflecting the substantial proportion of moderate-to-severe DKA cases. Mechanical ventilation was required in only three children, indicating that respiratory failure remained relatively uncommon (3,8).

The mean time to DKA resolution was 17.9 ± 5.8 hours, which is comparable to previous pediatric studies reporting resolution within 12–24 hours following standardized treatment protocols (8,11). Mean hospital stay was 5.4 ± 2.1 days and increased significantly with DKA severity. Children with severe DKA remained hospitalized for significantly longer periods than those with mild disease (7.3 vs. 3.8 days; $p<0.001$). Similar findings have been documented previously, demonstrating that greater metabolic derangement requires prolonged monitoring, electrolyte correction, and intensive care support (5,9).

Hypokalemia (16.7%) was the most common complication observed during hospitalization, followed by hypoglycemia (10%), acute kidney injury (6.7%), shock (5%), cerebral edema (3.3%), and recurrent DKA (3.3%). Cerebral edema remains the most feared complication of pediatric DKA despite its low incidence and was observed only among children with severe DKA in the present study. These findings are consistent with ISPAD recommendations emphasizing cautious fluid administration, gradual correction of hyperglycemia, and frequent neurological assessment to minimize neurological complications (3,8).

The present study also demonstrated a strong association between increasing DKA severity and adverse clinical outcomes. PICU admission, hypokalemia, cerebral edema, and prolonged hospitalization were significantly more common among children with severe DKA. These observations highlight the importance of early diagnosis and aggressive evidence-based management before progression to advanced metabolic decompensation.

Overall survival at discharge was 98.3%, with only one death (1.7%). This favorable outcome reflects prompt diagnosis, adherence to standardized pediatric DKA management protocols, meticulous electrolyte monitoring, and intensive supportive care. Mortality rates comparable to those observed in the present study have been reported from centers implementing protocol-based management, whereas substantially higher mortality continues to be reported from resource-limited settings where delayed presentation and inadequate monitoring remain common (4,8,12).

The present study has certain limitations. It was conducted at a single tertiary-care center with a relatively small sample size, which may limit generalizability. Autoimmune antibody profiles and C-peptide estimation were not routinely available, and long-term follow-up after discharge was beyond the scope of the study. Nevertheless, the prospective design, standardized diagnostic criteria, and comprehensive clinical evaluation strengthen the validity of the findings.

In conclusion, the present study demonstrates that diabetic ketoacidosis remains a major cause of hospitalization among children with Type 1 Diabetes Mellitus, with newly diagnosed diabetes, poor glycemic control, missed insulin doses, and infections representing the major precipitating factors. Early diagnosis, caregiver education, strict adherence to insulin therapy, timely referral, and implementation of standardized ISPAD treatment protocols are essential for reducing complications, shortening hospital stay, and improving survival among children with DKA.

CONCLUSION

The present study demonstrated that diabetic ketoacidosis remains a major cause of hospitalization among children with Type 1 Diabetes Mellitus, with newly diagnosed diabetes, poor glycemic control, missed insulin doses, and infections being the most common precipitating factors. Most children presented with classical symptoms and responded well to standardized ISPAD-based management, resulting in a high recovery rate and low mortality. Severe DKA was associated with longer hospital stay, increased PICU admission, and a higher incidence of complications. Early diagnosis, timely referral, adherence to insulin therapy, regular diabetes education, and protocol-based management are essential to reduce DKA-related morbidity and improve clinical outcomes in children with T1DM.

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