

Original article

Clinical Presentation and Outcomes of Diabetic Ketoacidosis in Pediatric Patients: A Retrospective Study at Tripoli University Hospital

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Diabetic ketoacidosis (DKA) is an acute, potentially life-threatening complication of diabetes mellitus in children. It may be the first clinical manifestation of type 1 diabetes and can be accompanied by substantial fluid, electrolyte, and acid–base disturbances. Local data on pediatric DKA presentations and short-term outcomes can help identify priorities for earlier recognition and safer hospital care. To describe the clinical presentation, biochemical abnormalities, complications, and short-term hospital outcomes of children admitted with DKA to Tripoli University Hospital. This retrospective hospital-based study reviewed the clinical records of children aged 2–15 years admitted with DKA to Tripoli University Hospital during 2025–2026. The 59 DKA episodes were recorded. Demographic and clinical characteristics, DKA severity, laboratory results, treatment-associated electrolyte disturbances, and in-hospital outcomes were extracted from the records. The descriptive analyses and chi-square tests, with statistical significance defined as $p < 0.05$. The 59 DKA episodes had a mean age of 10 years. Females accounted for 74.6% of the sample, and 89.8% of episodes occurred in children newly diagnosed with type 1 diabetes. Vomiting was the most frequently reported symptom (32.2%), followed by abdominal pain (27.1%). Moderate and severe DKA were reported in 37.2% and 28.8% of cases, respectively. At admission, hypokalemia was reported in 8.5% (5/59), hyponatremia in 93.2%, and acute kidney injury in 10.2%. During treatment, hypokalemia and hypophosphatemia were reported in 24% and 45%, respectively. Mean reported blood-gas values improved from pH 7.12 and bicarbonate 8.8 mmol/L before treatment to pH 7.33 and bicarbonate 16.0 mmol/L after treatment. No in-hospital deaths were reported. In this hospital-based series, DKA frequently accompanied the initial diagnosis of type 1 diabetes, and electrolyte disturbances were reported both at admission and during treatment. No in-hospital deaths were recorded. The results support continued attention to early recognition of diabetes, timely referral, and systematic biochemical monitoring during DKA treatment.

Keywords. Diabetic Ketoacidosis; Type 1 Diabetes Mellitus; Children; Clinical Presentation.**Received:** 22/08/26**Accepted:** 19/10/26**Published:** 26/10/26**Copyright** © Khalij-Libya Journal (KJDMR) 2026.

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Introduction

Diabetic ketoacidosis (DKA) is one of the most serious acute metabolic emergencies in childhood diabetes mellitus. It develops when effective insulin activity is insufficient to suppress hepatic glucose production and ketone formation, resulting in hyperglycemia, ketonemia, and metabolic acidosis. DKA may occur in children with established diabetes or may be the first clinical manifestation of previously unrecognised type 1 diabetes mellitus (T1DM). Despite improvements in diabetes education and hospital protocols, DKA continues to contribute substantially to acute morbidity in children and adolescents and requires prompt recognition and structured treatment [1,2]. The clinical presentation of pediatric DKA is variable and may evolve over days or weeks. Polyuria, polydipsia, nocturia, weight loss, fatigue, and increased appetite can precede the acute presentation, but these symptoms may be overlooked or attributed to common childhood conditions. Vomiting, abdominal pain, dehydration, and deep or rapid breathing may dominate once metabolic decompensation develops. Because gastrointestinal symptoms can obscure the underlying metabolic disorder, clinicians should consider DKA in a child with vomiting or abdominal pain when accompanied by dehydration, altered breathing, weight loss, or other features suggestive of hyperglycemia [1,4].

DKA at the time of T1DM diagnosis remains an important public health and health-system concern. The likelihood of presentation in DKA is influenced by recognition of symptoms, access to timely assessment, and the effectiveness of referral pathways. A systematic review has identified multiple factors associated with DKA at diabetes onset, while studies from the Middle East, including Jordan and Kuwait, have described the burden and clinical characteristics of DKA among children presenting with newly diagnosed T1DM [5,7,20]. These findings support the value of local surveillance, public awareness, and clinician education, while recognising that the relative contribution of individual factors varies across populations and cannot be assumed without locally collected evidence. The diagnosis of DKA is based on the combination of hyperglycemia, ketosis, and metabolic acidosis. Assessment should include clinical hydration and circulatory status, neurological state, blood glucose, ketones, electrolytes, renal function, and acid–base measurements. DKA severity is commonly classified according to the degree of acidosis, and severity classification helps guide monitoring and level-of-care decisions. International Society for Pediatric and Adolescent Diabetes (ISPAD) guidance emphasises systematic assessment and treatment, with attention to fluid replacement, insulin administration, electrolyte management, and repeated clinical and biochemical evaluation [19].

Electrolyte disturbances are central to the pathophysiology and treatment of DKA. Osmotic diuresis, vomiting, and reduced intake contribute to water and electrolyte losses. Total-body potassium depletion may be present even when the initial serum potassium concentration is normal or elevated; serum potassium can fall after insulin is started and acidosis improves. Phosphate concentrations may also decline during treatment, particularly as metabolism and intracellular electrolyte distribution change. Accordingly, serial monitoring is essential to detect treatment-associated hypokalemia and hypophosphatemia and to support safe replacement when indicated [1,14,16,17,19]. Acute kidney injury (AKI) is another clinically important complication in children hospitalised with DKA. Severe dehydration and reduced renal perfusion can contribute to impaired kidney function, and renal indices should be interpreted in the context of hydration status and the course of treatment. Neurological complications, including cerebral injury, are less common but potentially devastating; careful monitoring and adherence to pediatric DKA protocols remain important throughout correction of the metabolic disturbance [10,11,19]. The clinical course therefore reflects not only the biochemical abnormalities present at admission but also the complications that may emerge during treatment.

Although international guidance provides a framework for DKA management, hospital-based data remain valuable for understanding local patterns of presentation, severity, treatment-associated biochemical changes, and short-term outcomes. Published pediatric studies from different settings demonstrate variation in presenting features, DKA at diagnosis, complications, and care pathways [2,4,7–9,15,20]. The aim was to describe the clinical characteristics and short-term outcomes of children admitted with DKA to Tripoli University Hospital. The specific objectives of this study were to describe the demographic characteristics of the participants and their diabetes diagnostic status; to summarise presenting symptoms, dehydration status, DKA severity, and admission biochemical findings; to describe electrolyte disturbances and other reported complications during admission and treatment; to examine the associations between DKA severity and selected clinical or laboratory variables; and to describe short-term outcomes, including intensive care unit (ICU) admission and in-hospital mortality, where these data were available.

Methods

Study Design and Setting

The study was described as a retrospective hospital-based analysis conducted at Tripoli University Hospital, Tripoli, Libya.

Study Population

Children aged 2–15 years admitted with diabetic ketoacidosis (DKA) were eligible. For consistency with the International Society for Pediatric and Adolescent Diabetes (ISPAD) 2022 guidance, DKA should be defined by hyperglycemia (blood glucose >200 mg/dL), metabolic acidosis (venous pH <7.30 or serum bicarbonate <18 mmol/L), and ketonemia or ketonuria. Severity should be classified using the most severe applicable biochemical criterion: mild DKA, venous pH <7.30 or bicarbonate <18 mmol/L; moderate DKA, pH <7.20 or bicarbonate <10 mmol/L; and severe DKA, pH <7.10 or bicarbonate <5 mmol/L. When pH and bicarbonate indicated different categories, the more severe category should be recorded. These definitions must be applied uniformly to all cases during chart abstraction. Exclusion criteria were non-diabetic metabolic acidosis and incomplete medical records.

Data Collection

Data were reportedly abstracted from hospital clinical records and the hospital database. Variables included age, sex, diabetes diagnostic status, symptoms, dehydration status, DKA severity, admission glucose and electrolytes, blood-gas measurements before and after treatment, ICU duration, renal function, treatment-associated potassium and phosphate abnormalities, and documented complications and outcomes.

Results

The 59 DKA episodes were in children aged 2–15 years, with a mean age of 10 years. Females represented 74.6% and males 25.4% of the sample. Newly diagnosed type 1 diabetes accounted for 89.8% of episodes, while 10.2% occurred in children with previously diagnosed type 1 diabetes. Vomiting was the most frequently reported symptom (19 cases; 32.2%), followed by abdominal pain (16 cases; 27.1%). Polyuria, polyphagia, and polydipsia were each reported in 12 cases (20.3%). Moderate DKA was reported in 37.2% of cases and severe DKA in 28.8%; mild DKA was reported in 34% of cases. Moderate dehydration was reported in 74.1% of children, mild dehydration in 24.7%, and severe dehydration in 1.2%. Admission glucose categories were reported as 24.1% below 350 mg/dL, 42.5% between 350 and 500 mg/dL, and 33.4% above 500 mg/dL. Admission hypokalemia was reported in five children (8.5%), hyponatremia in 55 children (93.2%), and acute kidney injury in six children (10.2%). The mean pH increased from 7.12 before treatment to 7.33 after treatment, bicarbonate increased from 8.8 to 16.0 mmol/L, PCO₂ increased from 22.4 to 27.7 mmHg, and base excess improved from –19.5 to –9.7 mEq/L. The post-treatment mean bicarbonate was 16.0 mmol/L. The analysis reports an association between fever and DKA severity ($p=0.034$) and between DKA severity and hypokalemia developing during treatment ($p=0.036$). It reports no statistically significant associations between DKA severity and age, sex, ICU days, or admission glucose, potassium, and sodium. During treatment, hypokalemia was reported in 21 patients (24%) and

hypophosphatemia in 39 (45%). The report reports no in-hospital deaths and states that all 59 patients survived to discharge.

Tables and Figures

Table 1. Demographic and diabetes diagnostic characteristics

Characteristic	Reported results
Total sample	59 DKA
Mean age	10 years
Female	74.6%
Male	25.4%
Newly diagnosed type 1 diabetes	89.8%
Previously diagnosed type 1 diabetes	10.2%

Table 2. Clinical presentation at admission

Presenting feature	n	Reported %
Vomiting	19	32.2
Abdominal pain	16	27.1
Polyuria	12	20.3
Polyphagia	12	20.3
Polydipsia	12	20.3
General weakness	3	3.5
Deep/rapid breathing	2	2.3
Diarrhea	2	2.3
Fever	1	1.7
Reduced level of consciousness	1	1.2
Lethargy	1	1.2

Table 3. DKA severity, dehydration, and reported complications

Variable	Reported result
Mild DKA	34.0%
Moderate DKA	37.2%
Severe DKA	28.8%
Mild dehydration	24.7%
Moderate dehydration	74.1%
Severe dehydration	1.2%
Hyponatremia at admission	93.2%
Hypokalemia at admission	8.5%
Acute kidney injury	10.2%
Hypokalemia during treatment	24%
Hypophosphatemia during treatment	45%

Table 4. Reported mean blood-gas values before and after treatment

Parameter	Before treatment	After treatment
pH	7.12	7.33
PCO ₂ (mmHg)	22.4	27.7
PO ₂ (mmHg)	59.6	67
Base excess (mEq/L)	-19.5	-9.7
Bicarbonate (mmol/L)	8.8	16.0

Discussion

This retrospective series describes the presentation and reported short-term outcomes of pediatric DKA at a tertiary hospital in Tripoli. The principal observations in most episodes were that children newly diagnosed with type 1 diabetes, vomiting and abdominal pain were frequent presenting symptoms, moderate or severe DKA accounted for a substantial proportion of reported cases, and electrolyte abnormalities were recorded both at admission and during treatment. No in-hospital deaths were reported. [2,4,7–9]. The high proportion of children described as newly diagnosed with type 1

diabetes makes recognition of early symptoms particularly relevant. Polyuria and polydipsia may be overlooked or attributed to other causes, while vomiting and abdominal pain can lead to an initial focus on gastrointestinal illness. A child presenting with vomiting, abdominal pain, dehydration, or deep breathing should therefore be assessed for hyperglycemia and ketosis when clinically indicated.

The present dataset, however, cannot establish the causes of delayed diagnosis unless symptom duration, prior healthcare contacts, and referral pathways were systematically recorded. [5,7,20]. The reported electrolyte abnormalities highlight the need for serial monitoring during DKA treatment. Potassium concentrations may be normal or elevated at presentation despite total-body potassium depletion, and potassium can fall as insulin therapy and correction of acidosis proceed. Phosphate may also decline during treatment. There was an association between fever and DKA severity and an association between severity and treatment-associated hypokalemia. [1,14,17,19]. The absence of recorded in-hospital deaths is an important descriptive finding; the reported post-treatment means pH of 7.33 and bicarbonate of 16.0 mmol/L indicate improvement in the group averages.

Conclusion

In this retrospective series from Tripoli University Hospital, pediatric DKA was frequently associated with the initial diagnosis of type 1 diabetes. Vomiting and abdominal pain were commonly documented, and electrolyte disturbances were reported at admission and during treatment. No in-hospital deaths were recorded. The results underscore the importance of early recognition of diabetes symptoms and close biochemical monitoring during DKA management.

Conflict of interest. Nil

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