

Prevalence and Precipitating Factors of Diabetic Ketoacidosis in Children with Type 1 Diabetes at St. Paul's Hospital, Addis Ababa

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Abstract

Background: Diabetic Ketoacidosis (DKA) is a life-threatening complication of Type 1 Diabetes Mellitus (T1DM). It remains a major cause of morbidity and mortality in children, often serving as the first presentation of the disease or a complication in established cases. This study aims to assess the prevalence of DKA among newly diagnosed pediatric patients and identify precipitating factors in known T1DM patients.

Methods: An institution-based retrospective cross-sectional study was conducted at St. Paul's Hospital Millennium Medical College (SPHMMC), Addis Ababa. Data were collected from the medical records of pediatric patients (aged <18 years) presented with T1DM between January 2017 and December 2022. Consecutive sampling was used to include 184 patients (84 newly diagnosed and 100 known T1DM with DKA). Data were analyzed using SPSS version 26.0.

Results: Among 84 newly diagnosed T1DM patients, 75 (89.3%) presented with DKA as their initial manifestation. Of these, 35.7% had severe DKA. A significant association was found between the lack of health insurance and DKA presentation at diagnosis (AOR 0.025, 95% CI 0.002-0.332, $p = 0.005$). Among the 100 known T1DM patients presenting with DKA, infection was the leading precipitating factor, accounting for 50% of cases, followed by insulin omission (13%).

Conclusion: The prevalence of DKA at the onset of T1DM is alarmingly high in this setting, with the vast majority of new patients presenting in crisis. Lack of health insurance is a significant barrier associated with delayed diagnosis. For known patients, infection remains the primary trigger for DKA. Strategies to improve early diagnosis and focused education on sick-day management are urgently needed.

Keywords: Diabetic Ketoacidosis; Type 1 Diabetes Mellitus; Pediatrics; Ethiopia; Precipitating Factors

Background

Type 1 Diabetes Mellitus (T1DM) accounts for approximately 90% of childhood diabetes cases. It is characterized by absolute insulin deficiency due to autoimmune beta-cell destruction [1]. Diabetic Ketoacidosis (DKA) is the most serious acute metabolic complication of T1DM, resulting from insulin deficiency and an excess of counter-regulatory hormones. It is the leading cause of death and permanent disability in children with new-onset diabetes [2].

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Globally, the frequency of DKA at the time of diagnosis varies significantly, ranging from 15% to 70%, with higher rates observed in developing nations [3,4]. In Ethiopia, previous studies have indicated high prevalence rates, suggesting delayed diagnosis and limited awareness [5,6]. Understanding the local magnitude of DKA at diagnosis and the specific risk factors driving it is crucial for developing targeted public health interventions.

Furthermore, in patients with established T1DM, DKA often recurs due to various precipitating factors such as infection, insulin omission, or pump failure. Identifying these triggers is essential for patient education and prevention of recurrent hospitalizations. This study aims to determine the prevalence of DKA in newly diagnosed pediatric patients and explore the precipitating factors in known T1DM patients at a tertiary care center in Addis Ababa.

Materials and Methods

Study settings and period

The study was conducted at St. Paul's Hospital Millennium Medical College (SPHMMC) in Addis Ababa, Ethiopia. SPHMMC is a tertiary referral hospital providing specialty services. The study utilized data from January 2017 to December 2022.

Study design and population

An institution-based retrospective cross-sectional study was employed. The study population included all children aged less than 18 years diagnosed with T1DM who visited the Emergency Outpatient Department (EOPD) and regular pediatric OPD during the study period.

Sample size and sampling procedure

A consecutive sampling technique was used. All pediatric patients meeting the inclusion criteria during the five-year period were included. The total sample size was 184 children, comprising 84 newly diagnosed T1DM patients and 100 known T1DM patients presenting with DKA. Patients with diabetes but without DKA were excluded from the precipitating factor analysis for known patients.

Data collection

Data were extracted from patient charts and registration logbooks using a structured data extraction format adapted for this study. Variables included sociodemographic characteristics (age, sex, residence, insurance status), clinical history (duration of symptoms, family history, previous medical visits), and laboratory parameters (blood glucose, urine ketones, electrolytes). DKA was defined as random blood sugar (RBS) ≥ 250 mg/dl, ketonuria, and ketonemia. Severity was classified based on clinical and laboratory parameters.

Statistical analysis

Data were cleaned, coded, and entered into EPI-Info version 7, then exported to SPSS Version 26.0 for analysis. Descriptive statistics were used to summarize the data. Bivariate and multivariate logistic regression analyses were performed to identify factors associated with DKA at initial diagnosis. A p-value of <0.05 was considered statistically significant.

Ethics consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College. A waiver of informed consent was granted due to the retrospective nature of the study using secondary data. Patient confidentiality was maintained by using codes instead of names.

Results

Sociodemographic characteristics

A total of 184 pediatric patients were included. Of these, 84 (45.7%) were newly diagnosed with T1DM, and 100 (54.3%) were known diabetics presenting with DKA.

Among the 84 newly diagnosed patients, the mean age was 7.25 years. The largest age group was 1-5 years (33.3%), followed by 10-14 years (32.1%). There was a slight female predominance (51.2%). Regarding health coverage, 69% of newly diagnosed patients did not have health insurance. Nearly half (47.6%) presented with malnutrition.

For the 100 known diabetic patients presenting with DKA, the majority (44%) were aged 10-14 years. Females accounted for 63% of this group. Unlike the newly diagnosed group, 52% of the known patients had health insurance.

Prevalence and clinical presentation in newly diagnosed patients

Of the 84 newly diagnosed patients, 75 (89.3%) presented with DKA as their first manifestation of diabetes. Only 9 (10.7%) were diagnosed without ketoacidosis.

Regarding the duration of symptoms prior to presentation, 40 (47.6%) were symptomatic for less than one week, while 32 (38.1%) had symptoms for 1-2 weeks. The most common presenting symptoms were polyuria and polydipsia (82.1%). Notably, 23 (27.4%) patients had visited a health facility within two weeks prior to the DKA diagnosis, where they were treated for other conditions such as pneumonia or tonsillitis, indicating missed opportunities for earlier diagnosis.

Severity and management

Among newly diagnosed patients with DKA, 39 (46.4%) had mild, 15 (17.9%) had moderate, and 30 (35.7%) had severe DKA. One death was recorded (mortality rate 1.19%), attributed to cerebral edema and septic shock.

Precipitating factors in known T1DM patients

Among the 100 known T1DM patients, 50% (n = 50) had a concurrent infection identified as the precipitating factor. The most common infections were acute tonsillopharyngitis (ATP), pneumonia, and urinary tract infections (UTI). Insulin omission/discontinuation was the cause in 13 patients, citing reasons such as unavailability of medication, financial constraints, or preference for herbal treatment.

Type of Infection	Frequency	Percentage (%)
Acute Tonsillopharyngitis (ATP)	16	32.0
Pneumonia	4	8.0
Urinary Tract Infection (UTI)	3	6.0
Acute Gastroenteritis (AGE)	4	8.0
Gastritis	4	8.0
Vaginal Candidiasis	4	8.0
Others (Sepsis, Abscess, etc.)	15	30.0
Total	50	100.0

Table 1: Identified infections in known DM patients with DKA (N = 50).

Factors associated with DKA at onset

In multivariate analysis, the absence of health insurance was significantly associated with presenting with DKA at diagnosis. Children with health insurance were significantly less likely to present with DKA compared to those without (AOR 0.025, 95% CI 0.002-0.332, $p = 0.005$).

Discussion

This study reveals an alarming 89.3% prevalence of DKA among children newly diagnosed with T1DM. This finding is consistent with previous studies in Ethiopia (80%) [6] and other developing nations like the UAE (80%) and South Africa (69.8%) [7]. In contrast, developed nations such as Sweden and Canada report significantly lower rates (14-19%) [3], highlighting the disparity in early detection and healthcare access.

A critical finding in our study was that 27.4% of patients had visited a healthcare facility within two weeks prior to their DKA diagnosis but were treated for other conditions. This suggests a low index of suspicion for diabetes among primary healthcare providers, contributing to delayed diagnosis and disease progression to DKA.

We identified a strong protective association with health insurance. Children without insurance were far more likely to present in DKA. Lack of insurance often correlates with lower socioeconomic status, financial barriers to seeking care, and delayed presentation, which allows metabolic decompensation to occur.

For patients with established diabetes, infection was the predominant precipitating factor (50%). This differs from some previous Ethiopian studies in Jimma and Bahir Dar, which identified insulin omission and poor storage as primary causes [8,9]. This shift might suggest improved insulin availability or education regarding adherence, but it underscores the need for better “sick day” management protocols to prevent DKA during intercurrent illnesses.

Limitations of the Study

This was a single-center retrospective study, which may limit generalizability. The reliance on medical records meant that some data points were subject to documentation quality.

Conclusion

DKA remains the predominant mode of presentation for pediatric T1DM in this setting, driven largely by delayed diagnosis and lack of health insurance. For those with established diabetes, infections are the main trigger for metabolic decompensation.

We recommend strengthening primary care training to recognize early signs of diabetes (polyuria, polydipsia) to reduce missed diagnoses. Furthermore, diabetes education for families must emphasize sick-day management to prevent DKA during infections. Expanding health insurance coverage could also play a vital role in improving timely access to care.

Ethics Consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College. A waiver of informed consent was granted for the use of secondary data.

Consent to Publish

Not applicable as data was anonymized.

Authors' Contribution

LM conceived the study, collected data, and performed analysis. BF supervised the study and reviewed the manuscript. Both authors approved the final manuscript.

Conflict of Interest

The authors declare no competing interests.

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Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Bibliography

1. Meglio AD., *et al.* "Type 1 diabetes". *Lancet* 391.10138 (2018): 2449-2462.
2. White NH. "Diabetic ketoacidosis in children". *Endocrinology and Metabolism Clinics of North America* 29.4 (2000): 657-682.
3. Usher-Smith JA., *et al.* "Variation between countries in the frequency of diabetic ketoacidosis at first presentation of type 1 diabetes in children: a systematic review". *Diabetologia* 55.11 (2012): 2878-2894.
4. Dabelea D., *et al.* "Trends in the prevalence of ketoacidosis at diabetes diagnosis: the SEARCH for diabetes in youth study". *Pediatrics* 133.4 (2014): e938-e945.
5. Atkilt HS., *et al.* "Clinical characteristics of diabetic ketoacidosis in children with newly diagnosed Type 1 diabetes in Addis Ababa, Ethiopia: a cross-sectional Study". *PLoS One* 12.1 (2017): e0169666.
6. Fantahun B and Gedlu E. "Prevalence of diabetic ketoacidosis in newly diagnosed diabetes mellitus pediatric patients in Tikur Anbessa Specialized Hospital". *Ethiopian Journal of Pediatrics and Child Health* 4.1 (2008): 1-8.
7. Reddy Y., *et al.* "Characteristics of children presenting with newly diagnosed type 1 diabetes". *South African Journal of Child Health* 7.2 (2013): 46-48.
8. Assefa B., *et al.* "Incidence and predictors of diabetic ketoacidosis among children with diabetes in west and east Gojjam zone referral hospitals, northern Ethiopia, 2019". *Italian Journal of Pediatrics* 46.1 (2020): 164.
9. Gebeyehu K., *et al.* "Assessment of clinical profiles, and treatment outcomes for children with diabetic ketoacidosis, in two hospitals selected from Addis Ababa, Ethiopia, 2020". *Ethiopian Journal of Health Development* 36.2 (2022).
10. Wolfsdorf JL., *et al.* "ISPAD Clinical Practice Consensus Guidelines 2018: Diabetic ketoacidosis and the hyperglycemic hyperosmolar state". *Pediatric Diabetes* 19.27 (2018): 155-177.
11. Hadgu FB., *et al.* "Diabetic ketoacidosis in children and adolescents with newly diagnosed type 1 diabetes in Tigray, Ethiopia: retrospective observational study". *Pediatric Health, Medicine and Therapeutics* 10 (2019): 49-55.
12. Qari FA. "Precipitating factors for diabetic ketoacidosis". *Saudi Medical Journal* 23.2 (2002): 173-176.

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