

CLINICAL PROFILE, COMORBIDITY BURDEN, AND PRESCRIBING PATTERNS IN DIABETIC KETOACIDOSIS: A CASE SERIES FROM A TERTIARY CARE HOSPITAL IN PESHAWAR, PAKISTAN

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Abstract

Background: Diabetic ketoacidosis (DKA) is a life-threatening acute complication of diabetes mellitus and remains one of the most frequently encountered diabetes-related emergencies, carrying appreciable morbidity and mortality if not promptly recognized and managed.

Objective: To characterize the demographic profile, presenting complaints, comorbidity burden, and pharmacotherapy prescribing pattern of patients admitted with diabetic ketoacidosis at a tertiary care hospital in Peshawar, Pakistan.

Methods: A retrospective medical chart review was conducted on 20 patients admitted with diabetic ketoacidosis to the Endocrinology Ward, Emergency Room, and Acute Medical Unit of Lady Reading Hospital, Peshawar. Structured data on demographics, presenting complaints, comorbidities, and prescribed medications were abstracted using a standardized proforma and analyzed descriptively.

Results: Of 20 DKA patients, 11 (55%) were male and 9 (45%) female. The largest age group was 10–19 years (7 patients, 35%), followed by 50–60 years (5, 25%). Most patients (12, 60%) resided in Peshawar. The commonest presenting complaints were nausea/vomiting and abdominal pain (6 patients each, 30%), followed by shortness of breath and unconsciousness (4 each, 20%). DKA occurred in the context of type 1 diabetes mellitus in 12 patients (60%) and type 2 diabetes mellitus in 3 (15%); sepsis (30%) and GIT distress (20%) were the leading associated comorbidities, with anemia, COPD, chronic and acute kidney disease, shock, urinary tract infection, and hypertension also observed. Insulin glargine (13 patients), biphasic insulin aspart (10), and human regular insulin (9) were the most frequently

prescribed antihyperglycemic agents, alongside broad-spectrum antibiotics (meropenem, ceftriaxone), proton-pump inhibitors, analgesics, and anticoagulants reflecting the multi-system supportive care these patients required.

Conclusion: DKA in this tertiary care cohort disproportionately affected male patients and adolescents/young adults, was frequently precipitated by infection-related comorbidity, and required multi-drug supportive regimens alongside insulin therapy. These findings support targeted patient education for adolescents and young adults with diabetes and reinforce the importance of early infection screening in patients presenting with DKA.

1. Introduction

Diabetic ketoacidosis (DKA) is an acute, life-threatening complication of diabetes mellitus characterized by hyperglycemia, ketonemia, and metabolic acidosis, arising from an absolute or relative deficiency of insulin combined with elevated counter-regulatory hormones.[1] Once considered a complication confined to type 1 diabetes mellitus, DKA is now well recognized to also occur in patients with type 2 diabetes mellitus under conditions of severe physiological stress, such as infection or acute illness.[1]

Precipitating factors for DKA commonly include infection, non-compliance with insulin therapy, newly diagnosed diabetes, and other acute medical or surgical stressors; infection alone is reported to account for 30–50% of precipitating causes worldwide, with urinary tract infection and pneumonia predominating.[2] Effective management of DKA requires timely diagnosis, coordinated fluid resuscitation, insulin therapy, and electrolyte replacement, guided by structured protocols such as those of the Joint British Diabetes Societies, alongside careful attention to comorbid conditions that may both precipitate the episode and complicate its management.

Despite the availability of standardized management guidelines, real-world prescribing and comorbidity patterns in DKA can vary substantially by setting, and locally generated evidence remains valuable for guiding clinical pharmacy practice and patient education initiatives in South Asian tertiary care hospitals. This study characterizes the demographic profile, presenting complaints, comorbidity burden, and pharmacotherapy prescribing pattern of patients admitted with DKA at a tertiary care hospital in Peshawar, Pakistan,

based on a structured clinical pharmacy chart review.

2. Materials and Methods

2.1 Study Design and Setting

A retrospective medical chart review was conducted in the Endocrinology Ward, Emergency Room, and Acute Medical Unit (AMU) of Lady Reading Hospital, Peshawar, Khyber Pakhtunkhwa, Pakistan, as part of a structured clinical pharmacy clerkship.

2.2 Data Collection

Data were collected using a structured proforma designed by the Department of Pharmacy, Sarhad University of Science and Information Technology, Peshawar, capturing patient demographics, chief complaints, history of present illness, past medical and personal history, medication history, physical examination findings, laboratory results, diagnosis, hospital treatment, and monitoring notes. A total of 20 cases of DKA were collected over a 3-month period (July–September 2023).

2.3 Inclusion and Exclusion Criteria

All patients with a diagnosis of diabetic ketoacidosis admitted during the data collection period were included. Patients with a primary diagnosis other than DKA and pregnant women were excluded.

2.4 Data Evaluation and Analysis

Collected case histories were screened to identify prescribing patterns, comorbidity profiles, and treatment approaches. Medication histories were analyzed for prior drug use, response, and compliance; hospital-based treatment was analyzed for indication and dosage appropriateness. Data were tabulated and

summarized using descriptive statistics (frequencies and percentages).

2.5 Ethical Considerations

Data collection was conducted with the permission of the hospital administration as part of an approved clinical pharmacy clerkship. No personally identifying information is presented in this manuscript; all case data were anonymized.

3. Results

Twenty patients admitted with diabetic ketoacidosis were included in this case series. The cohort comprised 11 male patients (55%) and 9 female patients (45%). Patient age ranged from 5 to 58 years; the largest age group was 10–19 years (7 patients, 35%), followed by 50–60 years (5, 25%), 20–30 years (4, 20%), and 31–40 and 41–50 years (2 each, 10%). Most patients (12, 60%) resided in Peshawar, with the remainder from Nowshera (3), Charsadda (2), and one each from Swat, Swabi, and North Waziristan (Table 1, Figure 1).

Table 1. Demographic profile and presenting complaints of DKA patients (n = 20).

Variable	Category	n	%
Sex	Male	11	55
	Female	9	45
Age group (years)	10–19	7	35
	20–30	4	20
	31–40	2	10
	41–50	2	10
	50–60	5	25
Area of residence	Peshawar	12	60
	Nowshera	3	15
	Charsadda	2	10
	Swat	1	5
	Swabi	1	5
	North Waziristan	1	5
Presenting complaint	Nausea / vomiting	6	30
	Abdominal pain	6	30
	Shortness of breath	4	20
	Unconsciousness	4	20

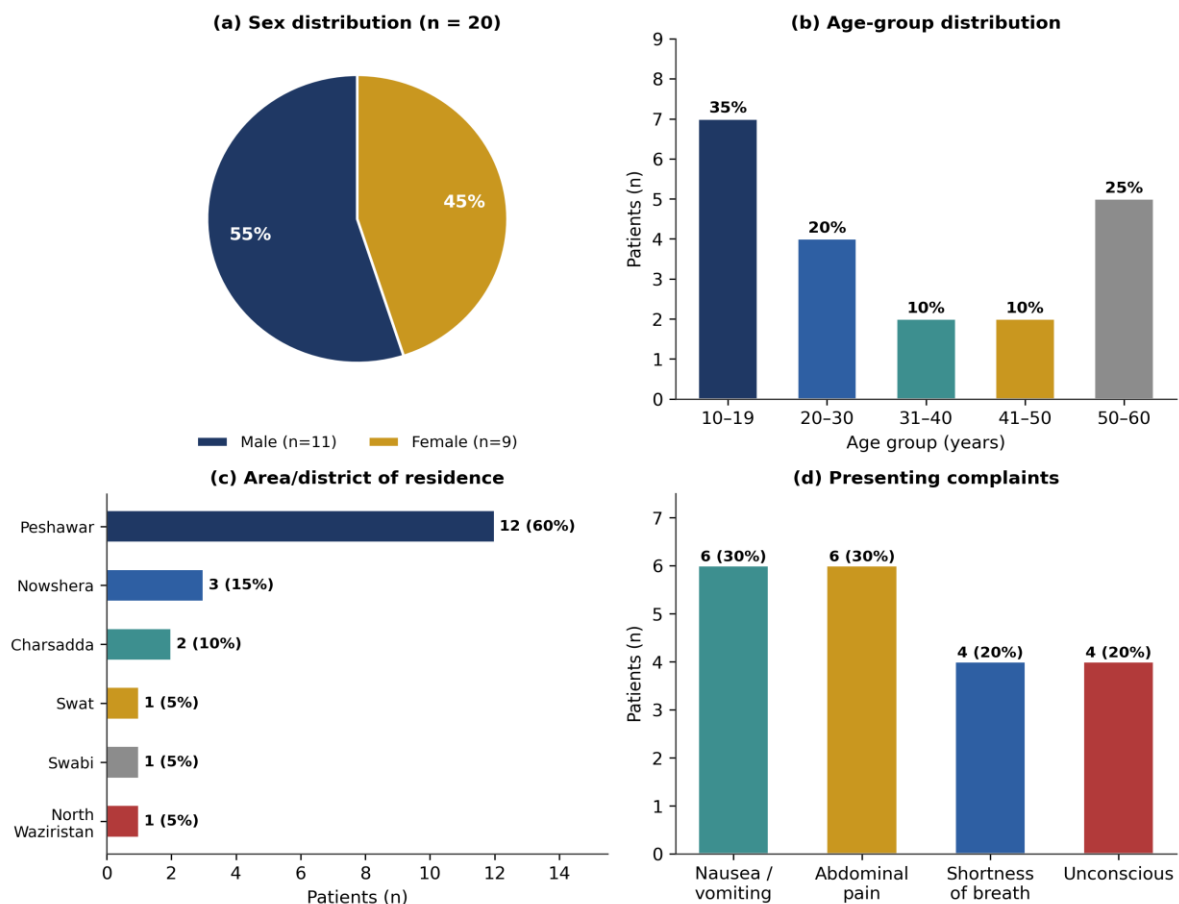


Figure 1. Demographic and clinical overview of the DKA cohort: (a) sex distribution, (b) age-group distribution, (c) area/district of residence, (d) presenting complaints (n = 20).

3.1 Comorbid and Associated Conditions

DKA occurred in the context of type 1 diabetes mellitus in 12 patients (60%) and type 2 diabetes mellitus in 3 patients (15%). The most frequent associated comorbidities were sepsis (6 patients, 30%) and gastrointestinal (GIT) distress (4, 20%), followed by anemia (3, 15%); chronic

obstructive pulmonary disease (COPD), chronic kidney disease, acute kidney disease, shock, urinary tract infection, and hypertension were each observed in 2 patients (10%); coronary artery disease, diabetic neuropathy, pneumonia, and osteoarthritis were each observed in 1 patient (5%) (Table 2, Figure 2).

Table 2. Comorbid and associated conditions among DKA patients (n = 20).

Condition	n	%
DKA with type 1 diabetes mellitus	12	60
Sepsis	6	30
DKA with type 2 diabetes mellitus	3	15
GIT distress	4	20
Anemia	3	15
COPD	2	10
Chronic kidney disease	2	10

Condition	n	%
Acute kidney disease	2	10
Shock	2	10
Urinary tract infection	2	10
Hypertension	2	10
Coronary artery disease	1	5
Diabetic neuropathy	1	5
Pneumonia	1	5
Osteoarthritis	1	5

Percentages do not sum to 100% as patients could have more than one comorbid or associated condition.

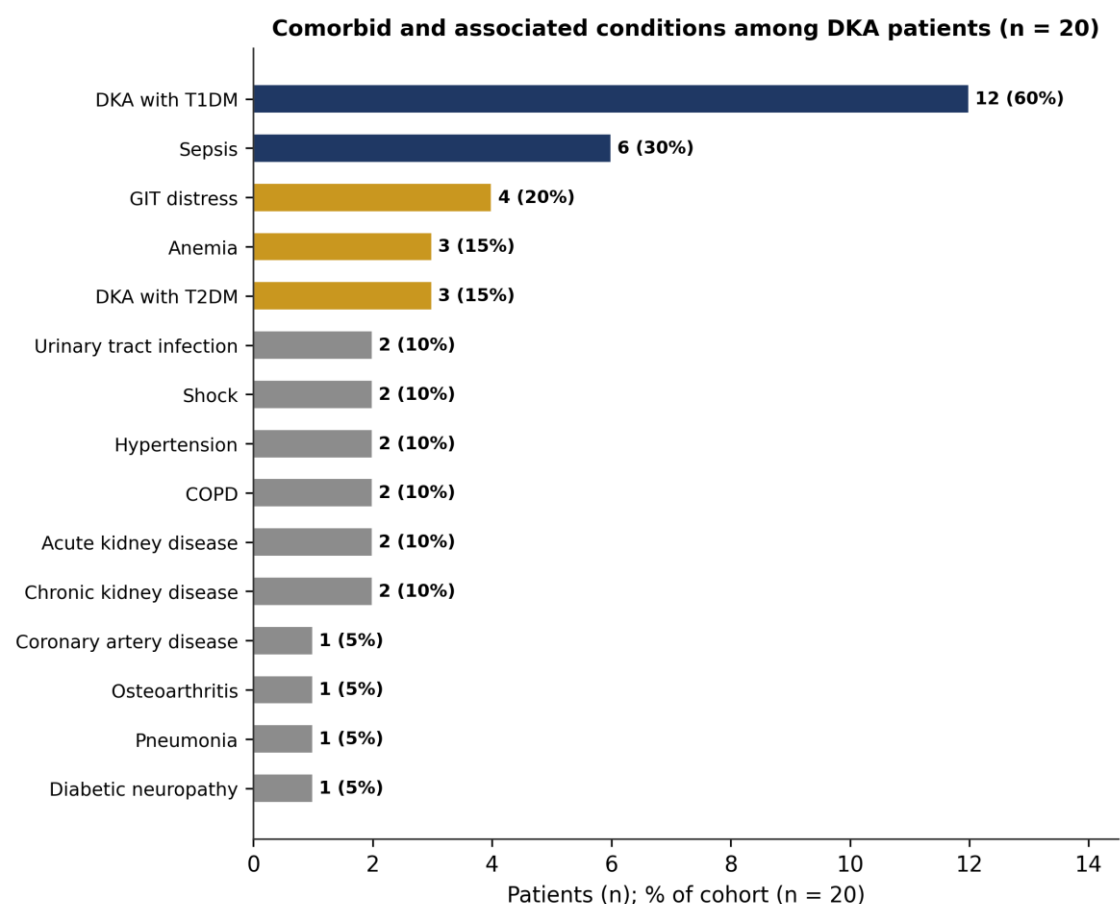


Figure 2. Comorbid and associated conditions among DKA patients, ranked by frequency (n = 20).

3.2 Prescribing Pattern and Treatment Approach

Insulin glargine was the most frequently prescribed antihyperglycemic agent (13 patients), followed by biphasic insulin aspart (10) and human regular insulin (9). Broad-spectrum antibiotics were commonly co-

prescribed, reflecting the high burden of infection-related comorbidity: meropenem (7 patients) and ceftriaxone (6) were the leading agents, with cefotaxime, metronidazole, and vancomycin also used. Supportive medications included omeprazole and paracetamol (6 patients each), enoxaparin (6), heparin (5),

aspirin (4), and electrolyte/acid–base agents such as sodium bicarbonate and potassium chloride (3 each) (Table 3, Figure 3).

Table 3. Most frequently prescribed medications in DKA management (n = 20).

Medication (generic)	Drug class	Patients, n
Insulin glargine	Long-acting insulin	13
Insulin aspart (biphasic 30/70)	Rapid/intermediate-acting insulin	10
Human regular insulin	Short-acting insulin	9
Meropenem	Carbapenem antibiotic	7
Ceftriaxone	Third-generation cephalosporin	6
Omeprazole	Proton-pump inhibitor	6
Paracetamol	Antipyretic/analgesic	6
Enoxaparin	Low-molecular-weight heparin	6
Heparin	Anticoagulant	5
Aspirin	Antiplatelet	4
Metronidazole	Antibacterial/antiprotozoal	3
Vancomycin	Glycopeptide antibiotic	3
Sodium bicarbonate	Alkalinizing agent	3
Esomeprazole	Proton-pump inhibitor	3
Potassium chloride	Electrolyte replacement	3

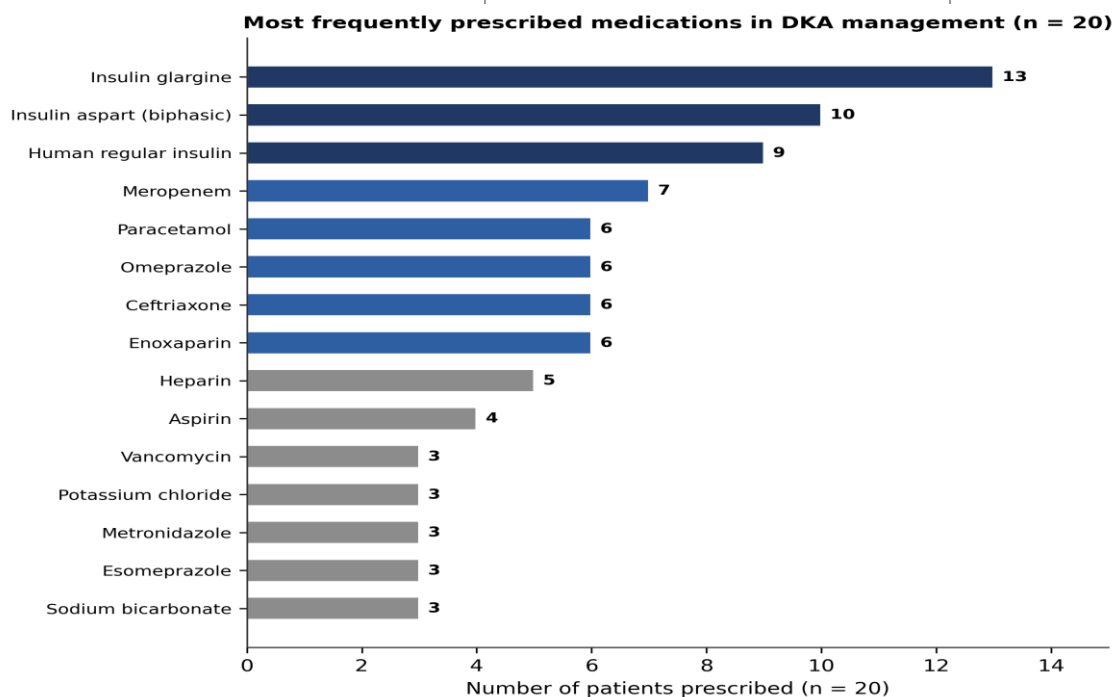


Figure 3. Most frequently prescribed medications in DKA management, ranked by number of patients (n = 20).

Grouping patients by their overall clinical presentation, three broad treatment clusters emerged: (i) patients presenting predominantly with abdominal pain and vomiting (8 patients) were managed with insulin therapy, pain relievers, antiemetics, and nutritional support; (ii) patients with polydipsia, shortness of breath, or drowsiness (7 patients) received intravenous

fluids, insulin therapy, electrolyte replacement, oxygen therapy, pain relievers, antiemetics, bronchodilators, and sedatives as needed; and (iii) patients presenting with seizures or unconsciousness (5 patients) received intravenous fluids, insulin therapy, electrolyte replacement, supportive care, anticonvulsants, and sedatives (Figure 4).

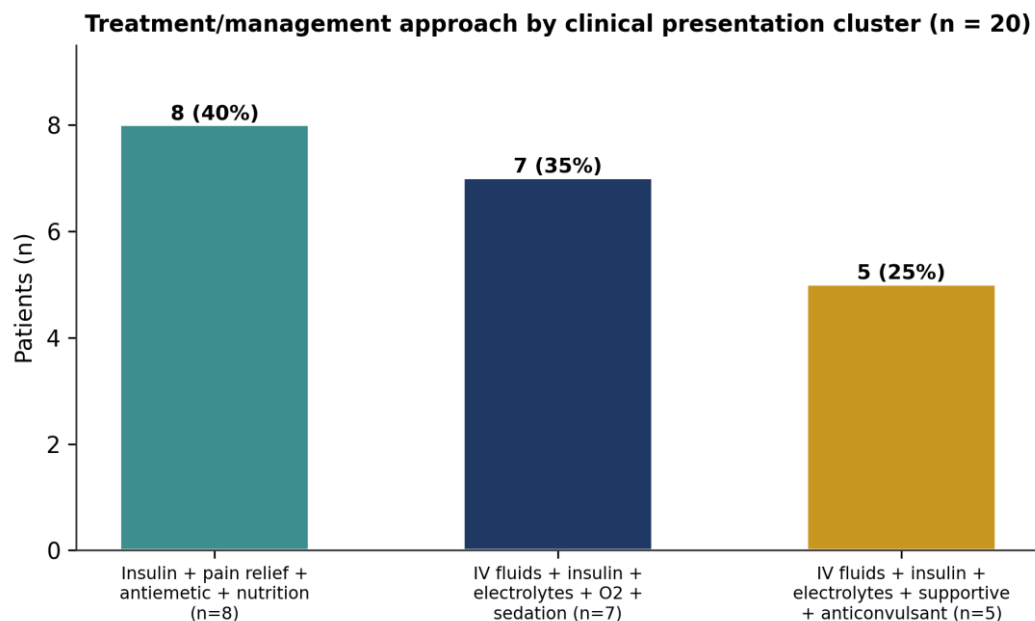


Figure 4. *Treatment/management approach by clinical presentation cluster (n = 20).*

4. Discussion

In this case series of 20 patients admitted with DKA at a tertiary care hospital in Peshawar, male patients were more frequently affected than females (55% vs. 45%), consistent with prior reports that DKA severity and frequency tend to be greater in male patients.[3] The 10–19 year age group carried the largest share of cases (35%), a pattern that aligns with the recognized peak incidence of type 1 diabetes-associated DKA in adolescence, when non-compliance with insulin therapy and psychosocial stressors are common precipitants; DKA severity has similarly been reported to be significantly associated with age, gender, prior DKA episodes, length of hospital stay, and non-compliance combined with infection.[3]

The predominance of patients from Peshawar (60%) likely reflects the hospital's role as the primary tertiary referral center for the surrounding districts, while cases from more remote areas such as North Waziristan, Swat,

and Swabi may reflect both referral patterns and disparities in local diabetes care infrastructure; prior work has linked inadequate patient knowledge of DKA signs, symptoms, and prevention to a higher burden of cases reaching tertiary care, particularly from areas with limited healthcare access.[4]

The high prevalence of infection-related comorbidity in this cohort – sepsis in 30% and GIT distress in 20% of patients, alongside urinary tract infection and pneumonia – is consistent with the well-established role of infection as the leading precipitating factor for DKA worldwide, accounting for an estimated 30–50% of episodes.[2] This underscores the importance of systematic infection screening (including urinalysis and chest evaluation) in any patient presenting with DKA, given that appropriately identifying and treating the precipitating infection is central to resolving the episode and preventing recurrence.

Prescribing patterns in this cohort reflected multi-system, guideline-consistent supportive care: insulin therapy (in various formulations) formed the therapeutic backbone, complemented by broad-spectrum antibiotics for infection, proton-pump inhibitors for gastrointestinal protection, anticoagulants for thromboprophylaxis, and electrolyte replacement consistent with recommended DKA management protocols. The use of three distinct clinical management clusters – tailored to whether patients presented with predominantly gastrointestinal, respiratory/neurological, or seizure/consciousness-related features – illustrates the individualized, presentation-driven nature of DKA management observed in this setting.

4.1 Strengths and Limitations

This study provides a detailed, patient-level clinical pharmacy perspective on real-world DKA presentation and management in a Pakistani tertiary care setting, based on structured chart review. The principal limitation is the small sample size ($n = 20$), reflecting the scope of a 3-month clinical clerkship, which limits statistical generalizability and precludes formal inferential analysis of associations between demographic or comorbidity factors and outcome. Findings should therefore be interpreted as a descriptive case series characterizing local practice patterns rather than a population-representative estimate. As with any retrospective chart review, data completeness was dependent on existing medical record documentation.

5. Conclusion

In this tertiary care case series, DKA disproportionately affected male patients and adolescents/young adults, occurred predominantly in the context of type 1 diabetes mellitus, and was frequently associated with infection-related comorbidity, particularly sepsis and gastrointestinal distress. Management combined insulin therapy with broad-spectrum antibiotics, gastrointestinal protection, anticoagulation, and electrolyte replacement, tailored to each patient's presenting clinical cluster.

5.1 Recommendations

- Target diabetes self-management education toward adolescents and young adults, given their disproportionate DKA burden in this cohort.
- Ensure systematic infection screening (urinalysis, chest assessment, sepsis workup) in all patients presenting with DKA, given the high prevalence of infection-related precipitants observed.
- Strengthen referral pathways and local diabetes care capacity in outlying districts to reduce delays in DKA recognition and management.
- Pursue larger, multi-center studies to enable formal statistical analysis of demographic and comorbidity predictors of DKA severity and outcome.

6. Declarations

Ethics approval and consent to participate

Data collection was conducted with the permission of the hospital administration as part of an approved clinical pharmacy clerkship at Lady Reading Hospital, Peshawar. All case data were anonymized prior to analysis.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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