CASE REPORT

Diabetic ketoacidosis in a thalassemia major patient with secondary hemochromatosis

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Biomedica - Official Journal of University of Health Sciences, Lahore, Pakistan
Volume XX(XX):1-4
https://doi.org/10.24911/BioMedica/5-1634

ABSTRACT

Background: Diabetic ketoacidosis (DKA) is a life-threatening acute hyperglycemic complication of diabetes mellitus (DM). Thalassemia major predisposes to DM due to pancreatic dysfunction from iron overload, yet DKA is uncommon in these patients.

Case Presentation: We report a case of an 18-year-old female with thalassemia major and secondary hemochromatosis who presented with acute shortness of breath, drowsiness, and confusion following one day of diarrhea. On examination, she was profoundly hypotensive (BP 54/21 mmHg), tachycardic (PR 131 bpm), hypoxic (SpO_2 89%), and exhibited acidotic breathing, pallor, bronze skin pigmentation, and cold extremities. Laboratory evaluation revealed severe anemia, marked leukocytosis (>30,000/mm³), metabolic acidosis with hypokalemia, hyperglycemia, and markedly elevated ferritin (>1650 ng/l). The patient was treated with insulin infusion, electrolyte correction, blood transfusion, iron chelation therapy, and supportive measures. She improved clinically, achieved metabolic stabilization, and was discharged in stable condition.

Conclusion: This case underscores that thalassemia-related iron overload can precipitate disturbances in glucose metabolism and rarely present with DKA. Continuous monitoring of glycemic status is essential in thalassemia patients, even when baseline glucose levels are normal, to enable early detection and management of acute metabolic complications.

Keywords: Diabetic ketoacidosis, thalassemia major, secondary hemochromatosis, iron chelation therapy.

Received: 11 February 2025 **Revised date:** 09 April 2025 **Accepted:** 06 June 2025

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Introduction

Thalassemia major is an inherited hemoglobinopathy that necessitates regular blood transfusions, which can lead to iron overload and consequent secondary hemochromatosis. Iron deposition in the pancreas may impair β-cell function, resulting in insulin deficiency and predisposing patients to glucose metabolism disorders, including diabetes mellitus (DM) and impaired glucose tolerance.[1] While diabetes is a recognized complication of thalassemia major, the occurrence of diabetic ketoacidosis (DKA) remains exceptionally rare and is infrequently reported in contemporary literature.[2]

The progressive decline in pancreatic β-cell function due to chronic iron accumulation is often insidious and asymptomatic until insulin production falls below a critical threshold.[3] This presents a clinical challenge, necessitating heightened vigilance among healthcare providers for early recognition of acute metabolic crises such as DKA.

Here, we report the case of a young female with thalassemia major and secondary hemochromatosis who developed DKA. Approval for publishing was obtained from the hospital, and written informed consent was secured from the patient prior to manuscript preparation. This case underscores the importance of continuous metabolic monitoring and prompt intervention to prevent life-threatening complications in this vulnerable population.

Case Presentation

An 18-year-old female with a known history of thalassemia major presented to the Emergency Department of Lady Reading Hospital Peshawar with an acute onset of shortness of breath, lethargy, and altered sensorium. The patient reported diarrhea for the preceding 24 hours, with no associated vomiting or abdominal pain. Her past medical history revealed no prior diagnosis of DM, and previous HbA1c measurements had consistently remained within the normal range.

On presentation, the patient appeared acutely ill, drowsy, and confused. Vital signs demonstrated profound hypotension (BP 54/21 mmHg), tachycardia (pulse rate 131 beats/min), and oxygen saturation of 89% on room air.

Respiratory examination revealed deep and rapid breathing consistent with Kussmaul respiration, suggestive of metabolic acidosis.

Physical examination showed bronze skin pigmentation, indicative of chronic iron overload, along with marked conjunctival pallor consistent with anemia and cold peripheral extremities. Neurological assessment demonstrated an altered mental status with a Glasgow Coma Scale score of 13/15.

Initial laboratory evaluation revealed severe anemia, marked leukocytosis (>30,000/mm³), metabolic acidosis, hypokalemia, and hyperglycemia, with a random blood glucose level exceeding the measurable range of the analyzer. Serum ferritin levels were markedly elevated (>1,650 ng/mL), consistent with significant iron overload.

Abdominal ultrasonography demonstrated hepatomegaly, with a liver span measuring approximately 20 cm (Figures 1-3).

Further laboratory assessment performed on the second day of admission revealed an HbA1c level of 5.6% (reference range: 4.0%-5.6%), indicating the absence of chronic hyperglycemia. Blood cultures remained negative after 48 hours of incubation, ruling out bacteremia.

Based on the clinical presentation and laboratory findings, the patient was diagnosed with DKA precipitated by previously undiagnosed DM secondary to iron-induced pancreatic dysfunction, in the setting of thalassemia major with secondary hemochromatosis.

The patient was admitted to the intensive care unit and managed according to standard DKA treatment protocols. Management included:

- Continuous intravenous insulin infusion to control hyperglycemia and suppress ketogenesis.
- Aggressive fluid resuscitation with isotonic saline to correct dehydration and severe hypotension.
- Electrolyte correction, particularly intravenous potassium replacement, to address hypokalemia.
- Packed red blood cell transfusions to manage severe anemia.
- Iron chelation therapy with deferoxamine to reduce systemic iron burden and prevent further organ damage.
- Empirical broad-spectrum antibiotics, initiated due to suspected infection, although subsequent blood cultures remained negative.

During hospitalization, the patient demonstrated progressive clinical improvement, with normalization of blood glucose levels, resolution of metabolic acidosis, and correction of electrolyte abnormalities. Hemodynamic stability was restored, with improvement in blood pressure and heart rate.

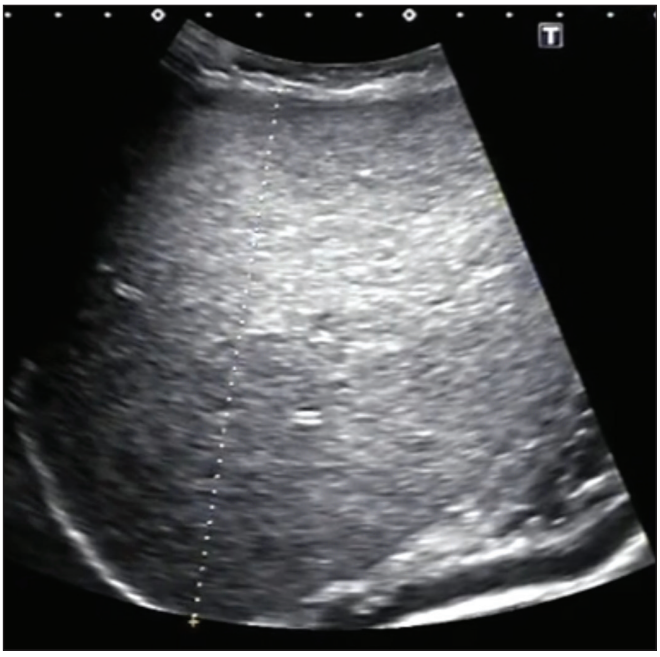

Figure 1. *Abdominal ultrasound showing hepatomegaly Abdominal ultrasound demonstrating an enlarged liver measuring approximately 20 cm in span. Computed tomography (CT) of the abdomen further confirmed hepatosplenomegaly with heterogeneous parenchymal texture.*

The patient was discharged after 5 days of hospitalization in stable condition, with instructions to continue insulin therapy and iron chelation treatment, and was scheduled for follow-up with endocrinology and hematology services.

Discussion

This case illustrates a rare presentation of DKA in a patient with thalassemia major complicated by secondary hemochromatosis. Patients with thalassemia major require regular blood transfusions, which frequently lead to progressive iron overload and deposition in multiple organs, including the pancreas.[4] Ion accumulation within pancreatic β-cells results in structural and functional damage, impairing insulin synthesis and secretion. Consequently, patients may develop abnormalities in glucose metabolism, including impaired glucose tolerance and DM.[5]

Excessive iron deposition within pancreatic islet cells contributes to cellular injury through oxidative stress-mediated mechanisms, which ultimately leads to β-cell apoptosis and reduced insulin production.[6] The development of pancreatic dysfunction in thalassemia patients is typically gradual and clinically silent, and symptoms often appear only after significant β-cell loss has occurred. In the present case, the normal HbA1c level indicated the absence of chronic hyperglycemia, suggesting an acute deterioration in insulin secretion rather than long-standing diabetes.

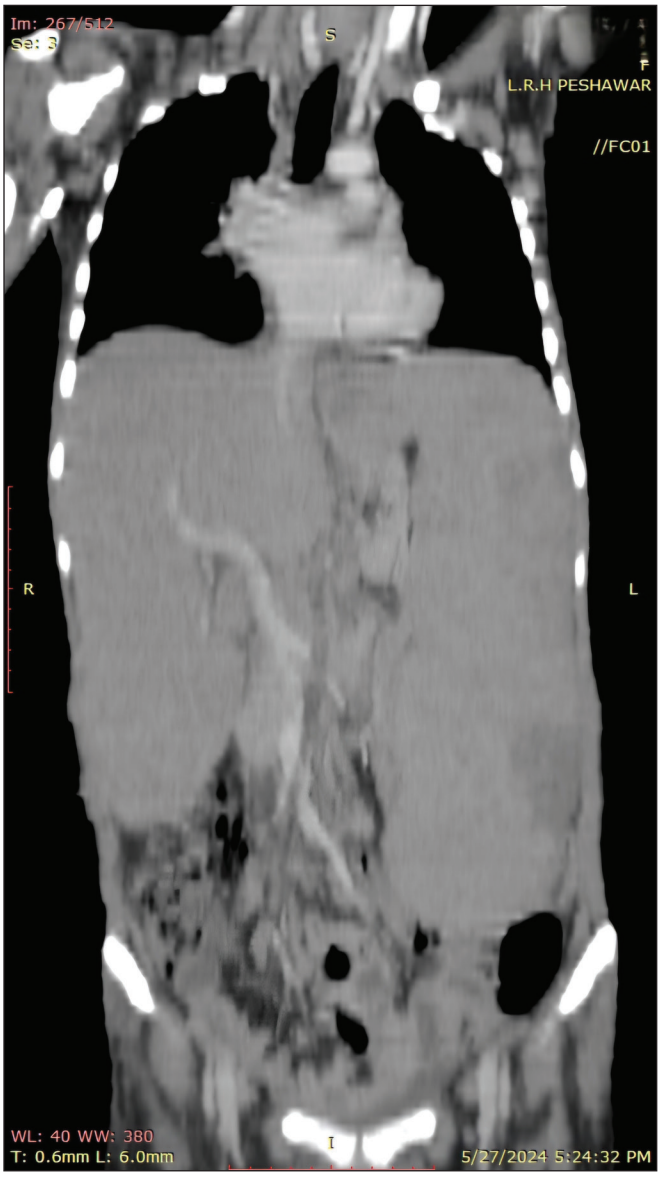

Figure 2. *Abdominal CT (coronal view) showing hepatosplenomegaly. Coronal CT image demonstrating hepatomegaly (liver enlarged to 20 cm) and splenomegaly (spleen enlarged to 27 cm) with heterogeneous parenchymal appearance.*

The occurrence of DKA in patients with thalassemia-related diabetes is uncommon and may pose diagnostic challenges. DKA is most frequently associated with type 1 DM, although it may also occur in type 2 diabetes during periods of physiological stress.[7] Various precipitating factors - including infection, dehydration, or metabolic stress - can trigger DKA by increasing insulin requirements and stimulating the release of counter-regulatory hormones. In the present case, the recent history of diarrhea likely resulted in dehydration and electrolyte imbalance, which may have acted as the precipitating factor for DKA.

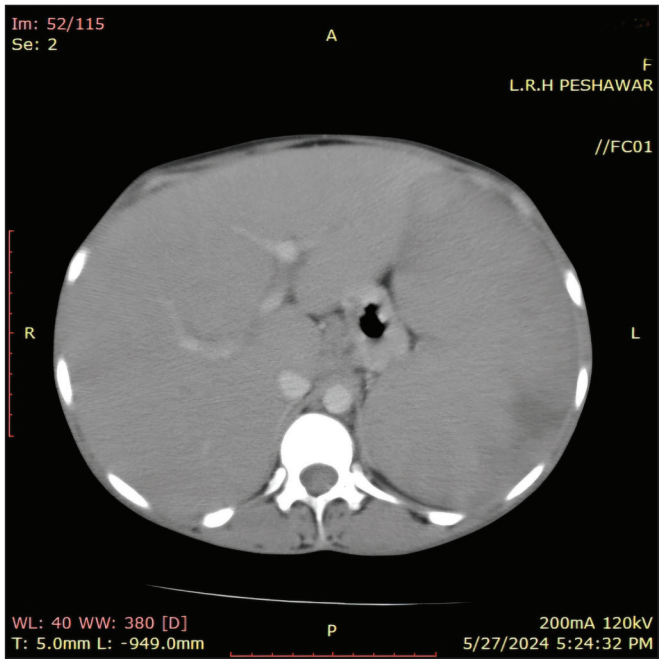

Figure 3. *Abdominal CT (axial view) showing hepatosplenomegaly. Axial CT image illustrating enlargement of both liver and spleen with heterogeneous parenchymal architecture.*

The management of DKA requires rapid correction of hyperglycemia, ketosis, dehydration, and electrolyte disturbances.[8] In patients with thalassemia major, treatment strategies must also address underlying anemia and iron overload. Blood transfusions may be required to correct severe anemia; however, repeated transfusions further contribute to systemic iron accumulation.[9] Therefore, iron chelation therapy remains a crucial component of long-term management to prevent iron-induced organ damage.

Another critical aspect of DKA management is the monitoring and correction of hypokalemia. Administration of insulin promotes intracellular potassium uptake, which can further lower serum potassium levels and predispose patients to life-threatening cardiac arrhythmias. Consequently, careful monitoring and timely potassium replacement are essential during treatment.

The available literature regarding DKA in patients with thalassemia major and iron overload remains limited. Recent studies emphasize the importance of early detection of abnormalities in glucose metabolism among thalassemia patients.[10] A study published in 2022 reported a higher prevalence of impaired glucose tolerance and DM in individuals with thalassemia major, supporting the recommendation for regular metabolic screening in this population.10 Nevertheless, reports of acute DKA in this context remain scarce, suggesting that the condition may be under-recognized or under-reported.

This case highlights the importance of maintaining a high index of clinical suspicion for acute metabolic complications in patients with thalassemia who present with nonspecific symptoms. Routine monitoring of glycemic status, even in patients without previously documented hyperglycemia, is recommended. Early identification and prompt management of metabolic disturbances may help prevent severe complications and improve overall patient outcomes.

Conclusion

This case highlights the uncommon yet clinically significant occurrence of DKA in a patient with thalassemia major complicated by secondary hemochromatosis. The case underscores the importance of regular monitoring of glucose metabolism in patients with transfusion-dependent thalassemia, even in the presence of previously normal glycemic parameters. Early recognition of metabolic abnormalities and timely, comprehensive management are essential to prevent potentially life-threatening complications and to improve overall clinical outcomes in this high-risk population.

Acknowledgement

The authors are thankful to the to Head and staff of the Department of Surgery, Lady Reading Hospital/ Medical Teaching Institute, Peshawar, Pakistan for their clinical and administrative support during execution of the study.

List of Abbreviations

CT	Computed tomography
DKA	Diabetic ketoacidosis
DM	Diabetes mellitus
GCS	Glasgow Coma Scale
ICU	Intensive care unit

Conflict of interest

None to declare.

Grant support and financial disclosure

None to disclose.

Ethical approval

The case was approved for publishing by the Head Department of Surgical C Ward, Lady Reading Hospital/ Medical Teaching Institute, Peshawar, Pakistan.

Author's contributions

AA, MUR, WU: Conception and design of study, acquisition of data, manuscript drafting with critical intellectual input.

SU: Acquisition of data, manuscript drafting with critical intellectual input.

ALL AUTHORS: Approval and full responsibility of the final version of the manuscript to be published.

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