

The role of specialists in contributing to the treatment of diabetic ketoacidosis

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2. *Internal medicine specialist*
3. *General Doctor*
4. *General Doctor*
5. *General Doctor*
6. *General Doctor*
7. *Pediatric emergency*
8. *Emergency Medicine*
9. *Respiratory Therapy*
10. *Family medicine specialist*
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14. *Family medicine specialist*
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16. *Obstetrics and gynecologist specialist*

Abstract

Diabetic ketoacidosis (DKA) is a serious and potentially life-threatening complication of diabetes that requires prompt and comprehensive management. This article outlined the multidisciplinary approach to treating DKA, highlighting the roles of various specialists. Internal medicine specialists and general practitioners are pivotal in the initial diagnosis and management, ensuring appropriate coordination of care. Pediatric emergency medicine and emergency medicine specialists provide critical acute treatment and continuous monitoring in emergency settings. Respiratory therapists monitor respiratory patterns and oxygen saturation to assess acidosis severity and detect complications like hypoxemia. Family medicine specialists contribute to holistic care by focusing on prevention, education, and the management of chronic aspects of diabetes. This coordinated approach, involving diverse medical expertise, ensures effective treatment, minimizes complications, and helps prevent future occurrences of DKA, underscoring the importance of teamwork in managing complex medical conditions.

Key words: Diabetic ketoacidosis,

Introduction

Diabetic ketoacidosis (DKA) is a critical and potentially life-threatening complication of diabetes mellitus [1]. It is characterized by hyperglycemia, ketosis, and metabolic acidosis. While DKA can occur in both type 1 and type 2 diabetes, it is more common in type 1 diabetes. DKA occurs more frequently with type 1 diabetes, although 10% to 30% of cases occur in patients with type 2 diabetes [2]. Management requires a multidisciplinary approach involving various specializations to ensure comprehensive care. Ketoacidosis is a metabolic state associated with pathologically

high serum and urine concentrations of ketone bodies, namely acetone, acetoacetate, and beta-hydroxybutyrate [3].

Diabetic ketoacidosis (DKA) is a severe complication of diabetes marked by uncontrolled high blood sugar, metabolic acidosis, and elevated ketone levels in the body. It is most observed in individuals with type 1 diabetes mellitus, though it can occasionally occur in those with type 2 diabetes mellitus [2]. DKA arises from a relative or absolute insulin deficiency, exacerbated by hyperglycemia, dehydration, and acidosis. Typically, it is triggered by an infection, new-onset diabetes, or non-compliance with treatment.

Pathophysiology

Diabetes mellitus is characterized by insulin deficiency and increased plasma glucagon levels, which can be normalized by insulin replacement [4]. Normally, once serum glucose concentration increases, it enters pancreatic beta cells and leads to insulin production. Insulin decreases hepatic glucose production by inhibiting glycogenolysis and gluconeogenesis [5]. Glucose uptake by skeletal muscle and adipose tissue is increased by insulin. Both mechanisms result in the reduction of blood sugar [6]. In diabetic ketoacidosis, insulin deficiency and increased counter-regulatory hormones can lead to increased gluconeogenesis, accelerated glycogenolysis, and impaired glucose utilization. This will ultimately cause worsening hyperglycemia [4].

Insulin deficiency and increased counterregulatory hormones also lead to the release of free fatty acids into circulation from adipose tissue (lipolysis), which undergo hepatic fatty acid oxidation to ketone bodies (beta-hydroxybutyrate and acetoacetate), resulting in ketonemia and metabolic acidosis [7].

The pathophysiology of diabetic ketoacidosis (DKA) stems from a severe insulin deficiency, which triggers a cascade of metabolic disturbances. This deficiency results in increased hepatic glucose production and reduced peripheral glucose utilization, leading to significant hyperglycemia. Concurrently, enhanced lipolysis occurs, releasing free fatty acids that are subsequently converted into ketone bodies, causing ketosis and metabolic acidosis. Additionally, the marked hyperglycemia induces osmotic diuresis, leading to dehydration and significant electrolyte imbalances, which further complicate the clinical picture of DKA [8].

Clinical Presentation: DKA presents with [9]:

- Polyuria, polydipsia, and weight loss.
- Nausea, vomiting, and abdominal pain.
- Dehydration signs such as dry mucous membranes, tachycardia, and hypotension.
- Kussmaul respirations (deep, rapid breathing) as a compensatory response to acidosis.
- Fruity breath odor due to acetone.
- Altered mental status, ranging from confusion to coma.

DKA Risk Factors

Anyone who has diabetes can get diabetic ketoacidosis. Some people find out that they have diabetes only after they get DKA. However, certain things make you more likely than other people with diabetes to get DKA. Diabetic ketoacidosis (DKA) is a serious diabetic complication indicated by ketonemia, hyperglycemia, and metabolic acidosis [10]. The risk factors include:

1. **Type of diabetes:** People with type 1 diabetes are more likely to get DKA, and it's often more serious than it is in people with type 2 diabetes [11].
2. **Age:** Older adults are more likely to get complications from diabetes, including DKA, and it can be even more serious than it is in younger people. Among children with diabetes, kids under 5 are more likely to get it. Children assigned female at birth are more likely to get it around the age of puberty [9].
3. **Access to insulin:** In the U.S., about 1 in 5 people with diabetes who need insulin don't take their insulin as often as their doctor wants them to, take smaller doses than they need, or go without because insulin costs too much.
4. **Missing meals:** Not eating regularly can cause the body to start producing too many ketones.
5. **Family history of diabetes or autoimmune diseases:** This can put a person at risk of getting type 1 diabetes. Undiagnosed Type 1 diabetes can lead to DKA.
6. **Infections:** Infection such as pneumonia and urinary tract infection are the most important factors causing diabetic ketoacidosis, followed by lack of compliance with treatment, acute bodily injury such as trauma or surgery, as well as acute cardiac and pulmonary diseases such as myocardial infarction and pulmonary embolism.
7. **Diabetic ketoacidosis:** Diabetic ketoacidosis is a medical emergency that requires immediate treatment to reduce serious and potentially fatal complications [12].

Diagnosis DKA diagnosis involves clinical assessment and laboratory tests [13]:

- Blood glucose > 250 mg/dL (adults), > 200 mg/dL (children).
- Arterial pH < 7.3, venous pH < 7.25.
- Serum bicarbonate < 15-18 mEq/L.
- Presence of ketonemia or ketonuria.

Management Effective management of DKA requires a coordinated approach:

1. **Fluid Replacement:**
 - Initial rapid infusion of isotonic saline (0.9% NaCl) to restore circulating volume and renal perfusion.
 - Adjust fluids based on hemodynamic status and serum sodium levels.
2. **Insulin Therapy:**
 - Continuous intravenous infusion of regular insulin to reduce blood glucose levels and inhibit ketogenesis.
 - Avoid initial insulin bolus to prevent rapid electrolyte shifts.

3. **Electrolyte Management:**

- Potassium: Monitor closely and replace as needed to prevent hypokalemia.
- Bicarbonate: Reserved for severe acidosis (pH < 6.9).

4. **Monitoring:**

- Frequent monitoring of blood glucose, electrolytes, and acid-base status.
- Continuous clinical assessment to monitor for resolution of DKA.

Roles of specialists in dealing with DKA

Management of diabetic ketoacidosis (DKA) requires collaboration between various specialists to ensure comprehensive care. Below is an explanation of how different specialists contributing to the treatment and management of patients with diabetic ketoacidosis:

1. Internal Medicine Specialists and General Practitioners

Internal medicine specialists and general practitioners play a crucial role in the initial identification and ongoing management of DKA [13]. They:

- **Initial Diagnosis:** Often, these specialists are the first to suspect and diagnose DKA based on clinical symptoms such as excessive thirst, frequent urination, nausea, vomiting, abdominal pain, and altered mental status.
- **Initial Management:** They start the initial treatment, which includes intravenous (IV) fluid resuscitation to correct dehydration, IV insulin to reduce blood glucose levels, and monitoring electrolytes, especially potassium.
- **Coordination of Care:** Internal medicine specialists coordinate with other healthcare professionals to ensure comprehensive care, including consulting endocrinologists for specialized diabetes management.

2. Pediatric Emergency Medicine / Emergency Medicine Specialists

Emergency medicine specialists, including those specializing in pediatric care, are often the first responders to acute DKA cases [14]. They:

- **Emergency Assessment:** Conduct rapid assessment and stabilization, focusing on airway, breathing, and circulation (ABCs).
- **Acute Treatment:** Initiate immediate treatment protocols, which include IV fluids to address dehydration, IV insulin to control hyperglycemia and ketosis, and electrolyte replacement.
- **Monitoring and Transfer:** Continuously monitor vital signs, blood glucose, ketone levels, and electrolytes. They ensure the patient is stabilized before transferring to an appropriate care setting, such as an intensive care unit (ICU) or pediatric ICU for severe cases.

3. Respiratory Therapy

Diabetic Ketoacidosis (DKA) is a severe diabetes complication characterized by high levels of blood acids called ketones, necessitating prompt medical attention. Although not the primary treatment, respiratory therapy plays a vital supportive role in managing DKA. Respiratory therapists monitor respiratory patterns and oxygen saturation to assess acidosis severity and detect complications like hypoxemia [15]. They may administer supplemental oxygen or employ non-invasive ventilation methods like CPAP or BiPAP for respiratory distress, and in severe cases, manage mechanical ventilation. Airway protection is essential for patients with altered mental status to prevent aspiration [11]. Additionally, respiratory therapists educate patients on breathing techniques, diabetes control, and early DKA symptom recognition, working collaboratively with the healthcare team to manage respiratory complications and support primary treatments, including fluid replacement, insulin therapy, and electrolyte management.

4. Family Medicine Specialists

Family medicine specialists provide holistic care for DKA patients, focusing on both immediate treatment and long-term management [16]. They:

- **Initial and Follow-Up Care:** Manage the initial treatment of DKA and ensure follow-up care to monitor recovery and prevent recurrence.
- **Education and Prevention:** Educate patients and their families about DKA prevention, including proper insulin usage, recognizing early symptoms, and managing diabetes during illness.
- **Chronic Disease Management:** Integrate diabetes management into the overall healthcare plan, addressing other health issues and promoting a healthy lifestyle to reduce the risk of future DKA episodes.

5. Obstetrics and gynecologist specialist

Diabetic ketoacidosis (DKA) is a serious complication of diabetes that requires immediate medical attention. OB/GYN specialists play crucial roles in the treatment of DKA in pregnant women, including early identification and diagnosis by recognizing symptoms such as hyperglycemia, ketonuria, dehydration, nausea, vomiting, abdominal pain, and altered mental status. They work closely with endocrinologists, diabetologists, critical care specialists, and neonatologists for coordinated care. OB/GYNs are responsible for continuous maternal and fetal monitoring, addressing pregnancy-related complications like preterm labor and fetal distress, ensuring appropriate fluid resuscitation, managing insulin therapy in collaboration with endocrinologists, and providing nutritional support. They also educate patients about DKA, offer psychological support, and ensure close follow-up post-recovery to monitor health and prevent recurrence. By fulfilling these roles, OB/GYN specialists contribute to the comprehensive care of pregnant women with DKA, ensuring the best possible outcomes for both mother and baby.

So, managing DKA involves a multidisciplinary approach where each specialist contributes to different aspects of patient care. Internal medicine specialists and general practitioners handle

initial diagnosis and management, emergency medicine specialists provide acute treatment, psychotherapists address psychological factors, and family medicine specialists offer comprehensive and preventive care. This collaborative approach ensures effective treatment and helps prevent future episodes of DKA.

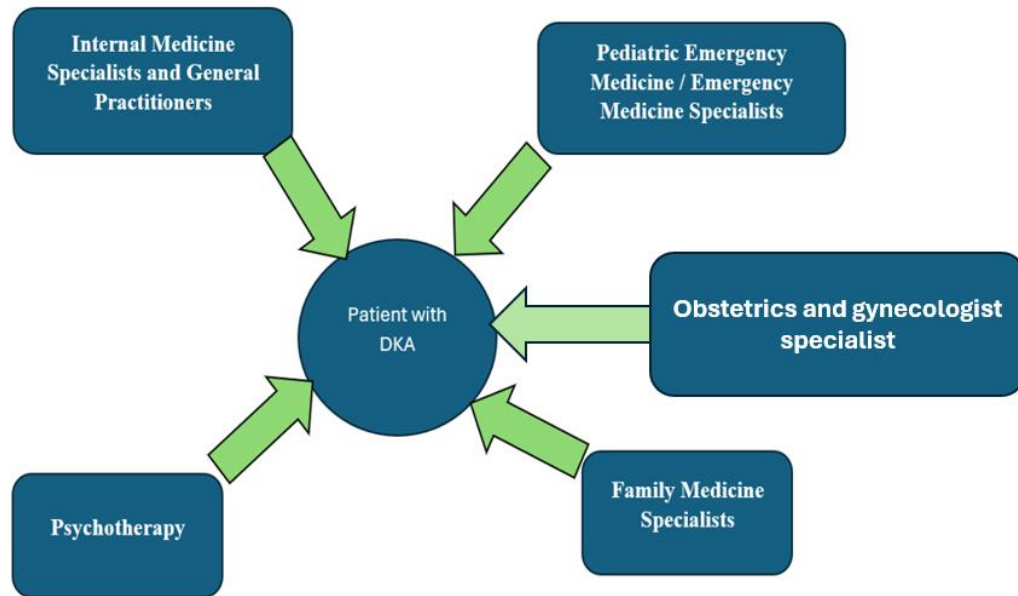


Figure 1: Multidisciplinary Approach to Managing DKA Patients

Complications of diabetic ketoacidosis

DKA complications are possible if you don't have emergency treatments such as electrolyte replacement and insulin. They include:

- Hypoglycemia and hypokalemia due to treatment.
- Brain swelling (cerebral edema) if blood sugar levels are adjusted too quickly
- Acute respiratory distress syndrome (ARDS).
- Thrombosis due to dehydration and hyper viscosity
- Loss of consciousness
- Death [13].

Prevention Preventing DKA involves:

- Patient education on proper diabetes management, including insulin administration and blood glucose monitoring.
- Recognizing early symptoms of DKA.
- Implementing sick day rules to manage diabetes during intercurrent illnesses [8].

Conclusion

Effective management of diabetic ketoacidosis (DKA) requires a multidisciplinary approach involving various specialists. Internal medicine specialists and general practitioners play a critical role in the initial diagnosis, management and coordination of care. Pediatric and emergency medicine specialists are essential for acute evaluation and immediate treatment in emergency situations. Respiratory therapists educate patients on breathing techniques, diabetes control, and early DKA symptom recognition, working collaboratively with the healthcare team to manage respiratory complications and support primary treatments, including fluid replacement, insulin therapy, and electrolyte management. Family medicine specialists ensure comprehensive care and ongoing, with a focus on education, prevention, and chronic disease management. This collaborative approach ensures that all aspects of the patient's condition are addressed, leading to better outcomes and preventing future episodes of diabetic ketoacidosis. The integration of efforts from these diverse fields highlights the importance of teamwork in the management of complex medical conditions such as diabetic ketoacidosis.

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