Case Vignette

A 32-year-old male with type 1 diabetes since the age of 14 years was taken to the emergency room because of drowsiness, fever, cough, diffuse abdominal pain, and vomiting.

Fever and cough started 2 days ago, and the patient could not eat or drink water. He has been treated with an intensive insulin regimen. On examination he was tachypneic, his temperature was 39° C (102.2° F), pulse rate 104 beats per minute, respiratory rate 24 breaths per minute, blood pressure 100/70 mmHg; he also had dry mucous membranes, poor skin turgor, and rales in the right lower chest. He was slightly confused.

Case Vignette

Rapid hematology and biochemical tests showed hematocrit 48%, hemoglobin 14.3 g/dl, white blood cell count 18,000/ µ l, glucose 450 mg/dl, urea 60 mg/dl (10.2 mmol/L), creatinine 1.4 mg/dl, Na+ 152 mEq/L, K+ 5.3 mEq/L, and Cl– 110 mmol/L. Arterial pH was 6.9, PO2 95 mmHg, PCO2 28 mmHg, HCO3 9 mEq/L, and O2 sat 98%. The result of the strip for ketone bodies in urine was strongly positive.

Diabetic Emergency (DKA) Dr. Nida Anjum, AP, MU-II, HFH





LECTURE CONTENT ANALYSIS

CORE CONTENT	70%
HORIZONTAL INTEGRATION	20%
VERTICAL INTEGRATION	5%
RESEARCH & ETHICS	5%

Learning Objectives

At the end of this lecture students should be able to:

- Define Diabetes Ketoacidosis.
- > Describe pathophysiology of Diabetic Ketoacidosis.
- > Describe diagnostic criteria and clinical features of DKA.
- > Enlist the laboratory investigations required for the diagnosis of DKA.
- > Outline the management plan for the patient of DKA.

Definition

Diabetic ketoacidosis is a medical emergency due to profound deficiency of insulin in the body and is characterized by hyperglycemia, ketosis, acidosis, and dehydration.

Pathophysiology of DKA





Legend:	Pathophysiology	Mechanism	Sign/Symptom/Lab Finding	Complications	Published June 17, 2013 on www.thecalgaryguide.com	(
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Diagnostic Criteria for DKA

All of these must be present to make the diagnosis

The 'D' – a blood glucose concentration of >11.0 mmol/L (> 200mg/dl) or known to have diabetes mellitus.

The 'K' – a capillary or blood ketone concentration of >3.0 mmol/L or

significant **ketonuria** (2+ or more on standard urine sticks)

The 'A' – a bicarbonate concentration of <15.0 mmol/L and/or venous pH <7.3.

Risk Factors

- Infections
- Infarction
- ➢ Ischemia
- Ignorance, e .g., poor compliance to Insulin

5ls

Intoxication, e.g., Alcohol

Clinical Features

Symptoms

Leg cramps

- ➤ Thirst
- Polyuria
- ➤ Fatigue
- > Weight loss
- Nausea, vomiting
- Abdominal pain
- Blurred vision

Clinical Features

Signs

- Dehydration
- Hypotension
- Tachycardia
- Reduced skin turgor
- Kussmaul breathing
- Acetone smell
- Cold peripheries

Confusion and drowsiness (10%)



*ADAM.

Kussmaul Respirations in Diabetic Ketoacidosis (DKA)

Recorded in UCIMC-ED

Laboratory Investigations

- Complete blood picture
- ➢ BSR
- Renal Function test
- Serum Electrolytes
- ➤ CRP
- Blood C/S
- ➢ ABGs
- Serum Ketones
- ➤ ECG

Pillars of DKA management

- > Volume resuscitation.
- Insulin to correct anion gap.
- Correction of electrolyte abnormalities.
- Treatment of precipitating cause.

Step 1: Fluid replacement

> 0.9% NaCl 1Liter at 0 hour.

▶0.9% sodium chloride 1L over 2 hours

> 0.9% sodium chloride 1L over next 2 hours

➤0.9% sodium chloride 1L over next 4 hours

> Add 10% glucose 125ml/hr if blood glucose falls below 250 mg/dl.

Step 2: Insulin replacement

Insulin Regular infusion @ 0.1IU/kg/hr.

Step 3: Potassium replacement

Potassium level (mmol/L)	Intravenous Potassium replacement
> 5.5	NIL
3.5 to 5.5	40 mmol/hr
< 3.5	Additional Potassium replacement

The recommended targets are

- Reduction of the blood ketone concentration by **0.5 mmol/L/hour**
- Increase the venous bicarbonate by 3.0 m/L/hour
- Reduce capillary blood glucose by 54 mg/L/hour
- Maintain potassium between 4.0 and 5.5 mEq/L/hour

Complications

- > Hypoglycemia
- ➢ Hypokalemia
- Cerebral edema
- Thromboembolic phenomenon
- Acute Kidney injury
- Cardiac arrythmias

Reading Resources

- 1. <u>http://www.diabetes.org.uk/joint-british-</u> <u>diabetes-society</u>
- 2. https://calgaryguide.ucalgary.ca/diabeticketoacidosis-dka/



Computer Methods and Programs in Biomedicine Update Volume 5, 2024, 100141



Artificial intelligence for diabetes: Enhancing prevention, diagnosis, and effective management

Mohamed Khalifa ^{a b c} 😤 🖾 , Mona Albadawy ^d

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Fig. 2. AI Enhances Eight Domains of Diabetes Management.

ETHICAL ISSUES

Ethical Issue	Key Concerns
Informed Consent and Capacity	Ensuring patients, especially those with altered mental status, provide valid consent when possible.
Resource Allocation	Prioritizing ICU beds and critical care resources during high-demand periods (e.g., mass casualty events).
Patient Autonomy	Respecting patient choices while ensuring life-saving interventions in emergencies.
Equity in Healthcare Access	Ensuring equal access to insulin, monitoring devices, and critical care for all socioeconomic groups.
End-of-Life Care Decisions	Ethical challenges when managing DKA in terminally ill or elderly patients with multiple comorbidities.
Research and Innovation Ethics	Adhering to ethical principles in clinical trials for new DKA treatments, including informed consent.
Confidentiality and Stigma	Maintaining privacy, especially in patients with recurrent DKA due to psychosocial issues like eating disorders.



Thank you