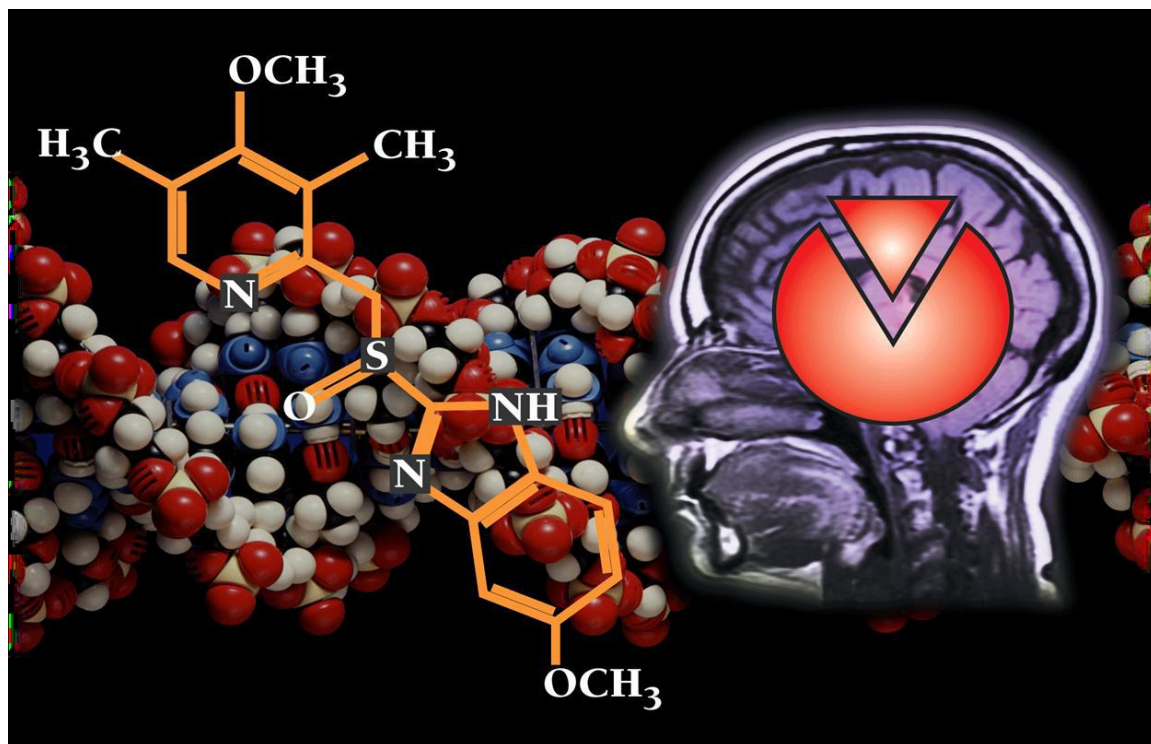


07-Management of Diabetic ketoacidosis



Note: Textboxes in thick blue margins are additional info.

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Introduction

Diabetic ketoacidosis

- Is an acute emergency state of severe uncontrolled diabetes associated with ketoacidosis **that requires admission to hospital.**
- It develops as a **result of insulin deficiency.**

Note: is usually seen in diabetes mellitus type 1

In Carbohydrates there is :

- ↑ glycogenolysis, ↑ gluconeogenesis

Protein

- ↑ proteolysis thus providing **amino acid** as precursors for **gluconeogenesis**. (leading to hyperglycemia)

Fats

↑ Fat breakdown to **free fatty acids** then to **acetyl-CoA** that is converted to **acetoacetic acid** and **β-hydroxybutyric acid** and **acetone (ketone bodies)** (leading to hyperketonemia & metabolic acidosis).

- Hyperglycemia-induced osmotic **diuresis & severe fluid loss. Leading to dehydration**
- **Fluid loss** induces **electrolyte imbalance (e.g. Hypokalemia)**
- **Metabolic acidosis** induces **hyperventilation**

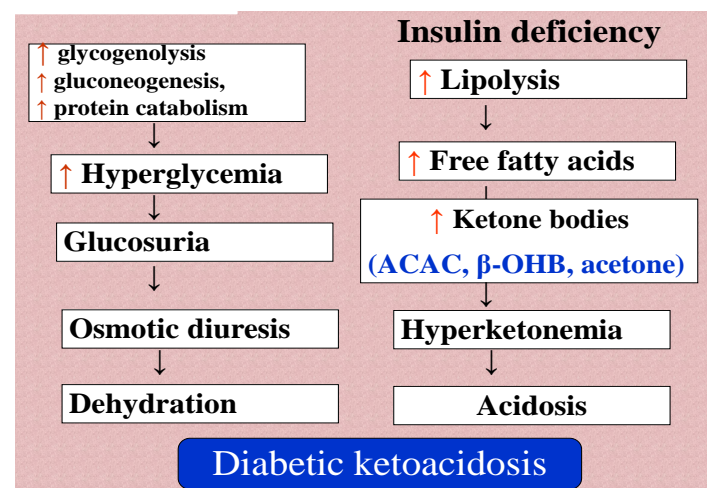
Characters of diabetic ketoacidosis

- Hyperglycemia
- Glucosuria
- Osmotic diuresis
- Polyuria
- Dehydration
- Electrolyte imbalance
- Thirst
- Polydipsia (increased drinking).
- Ketogenesis & Hyperketonemia
- Metabolic acidosis

Table 1: Typical water and serum electrolyte deficits in diabetic ketoacidosis

• Water	7	L
• Sodium	7–10	mmol/kg
• Potassium	3–5	mmol/kg
• Chloride	3–5	mmol/kg
• Phosphate	1–1.5	mmol/kg
• Magnesium	1–2	mmol/kg
• Calcium	1–2	mmol/kg

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Note: Hyponatremia, or low sodium, results from an increased flow of fluid out of the cells into the blood stream, **diluting the sodium level**. The symptoms of **hyponatremia** reflect brain swelling, as the excess fluid flows into the brain, causing cerebral edema. Signs of brain swelling include irritability, nausea and vomiting and seizures. Low potassium can also occur during **diabetic ketoacidosis**. The symptoms of low potassium, or hypokalemia, include **muscle cramps, constipation, weakness, and fatigue**. Hypokalemia can also cause **arrhythmias, or abnormal heart rhythms, which can be fatal**.

Lines of treatment of diabetic ketoacidosis

Adequate correction of :

- Hyperglycemia (*insulin*)
- Dehydration (*fluid therapy*)
- Electrolyte deficits (*potassium therapy*)
- Ketoacidosis (*bicarbonate therapy*)

1-Insulin therapy

Short acting insulins in IV formulation.

- **Regular insulin:** should be administered by means of continuous intravenous infusion in small doses through an infusion pump.

We give regular insulin because it is injectable , and When it enters the body, it works in the same way as natural insulin and increases overall ability for the body to uptake glucose.

2-Fluid therapy (Rehydration)

- Infusion of **isotonic saline** (0.9% sodium chloride) at a rate of 15–20 mL/kg/hour

3-Potassium therapy

- **potassium** replacement must be initiated.
- **potassium is** added to infusion fluid to correct the serum potassium concentration.

Note: **Potassium levels** can fluctuate severely during the treatment **of DKA**, because **insulin decreases potassium** levels in the blood by redistributing it into cells. A large part of the **shifted extracellular potassium** would have been lost in **urine because of osmotic diuresis**. This increases the risk of dangerous irregularities in the heart rate. Therefore, continuous observation of the heart rate is recommended

4-Bicarbonate therapy

- **Only if the arterial pH < 7.0 after 1 hour of hydration, bicarbonate therapy should be used (sodium bicarbonate should be administered in every 2 hours until the pH is at least 7.0).**

Hypoglycemia

- Is a life threatening disorder that occurs when blood glucose level becomes < 50 mg/dl.
- One of the common side effects of insulin in treating type I diabetes.

Causes of Hypoglycemia

- Excessive physical exercise
- Missed or delayed meal.
- Drug-induced hypoglycemia.
- Overdose of insulin in type I diabetes
- Overdose of oral hypoglycemic drugs in type II diabetes (*sulfonylurea - meglitinides*).
- Insulinoma.

Characters of Hypoglycemia

Autonomic features

- ↑ sympathetic: tachycardia, palpitation, sweating, anxiety, tremor.
- ↑ parasympathetic: nausea, vomiting.

Neurological defects:

- ✓ Headache, dizziness, delirium, visual disturbance, slurred speech.
- ✓ Mental confusion, seizures.
- ✓ Coma due to ↓ blood glucose to the brain.

Precautions in Diabetic patients who are using insulin

Hypoglycemia can be prevented by:

- Check your blood sugar level routinely
*blood sugar of **less than 70 mg/dl** is considered **hypoglycemia**.*
- Carry **glucose tablets or hard candy** to eat if your blood sugar gets too low.
- Wear a medical ID bracelet or carry a card that says you have diabetes.
- Do not skip meals or eat partial meals.
- Eat extra carbohydrates if you are more active than usual.
- Check your blood sugar more often when you are exercising more.

Treatment of Hypoglycemia

Conscious patient:

- **Sugar** containing beverage or food (15-30 g orally).

Unconscious patient:

- **Glucagon** (1 mg S.C. or I.M.)
- 20-50 ml of 50% **glucose solution I.V.**

	Hypoglycemic coma	Hyperglycemic coma Diabetic ketoacidosis
Onset	Rapid	Slow - Over several days
Insulin	Excess	Too little
Acidosis & dehydration	No	Ketoacidosis
B.P.	Normal	Subnormal or in shock
Respiration	Normal or shallow	air hunger
Skin	Pale & Sweating	Hot & dry
CNS	Tremors, mental confusion, sometimes convulsions	General depression
Blood sugar	Lower than 70 mg/100cc	Elevated above 200 mg/100cc
Ketones	Normal	Elevated

This table differentiates between Hypoglycemic and diabetic ketoacidosis

Summary

- **Hyperglycemic ketoacidosis:** is treated by **insulin, fluid therapy, potassium supplementation and bicarbonate.**

Adequate correction of:

- Hyperglycemia (**insulin**)
- Dehydration (**fluid therapy**)
- Electrolyte deficits (**potassium therapy**)
- Ketoacidosis (**bicarbonate therapy**)
- **Hypoglycemia:** is treated by **oral tablets, juice or honey (if patient is conscious)** and by **glucagon (1 mg S.C. or I.M.) or 20-50 ml of 50% glucose solution I.V. infusion (if patient is unconscious).**